SEQUENCE LISTING

<110> Microbial Technics Limited
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<120> Proteins

<130> PWC/P21122WO

<140> PCT/GB99/02452
<141> 1999-07-27

<150> GB 9816336.3
<151> 1998-07-27

<150> US 60/125329
<151> 1999-03-19

<160> 196

<170> PatentIn Ver. 2.1

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<213> Streptococcus pneumoniae

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<213> Streptococcus pneumoniae

<400> 2

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             20                  25                  30

Gly Ile Ser Val Gly Ile Gly His Leu Gln Gly Ser Ser Met Ala Lys
         35                  40                  45

Asn Asn Lys Val Ala Val Val Thr Thr Val Pro Ser Val Ala Glu Gly
     50                  55                  60

Leu Lys Asn Val Asn Gly Val Asn Phe Asp Tyr Lys Asp Glu Ala Ser
 65                  70                  75                  80

Ala Lys Glu Ala Ile Lys Glu Glu Lys Leu Lys Gly Tyr Leu Thr Ile
                 85                  90                  95

Asp Gln Glu Asp Ser Val Leu Lys Ala Val Tyr His Gly Glu Thr Ser
            100                 105                 110

Leu Glu Asn Gly Ile Lys Phe Glu Val Thr Gly Thr Leu Asn Glu Leu
        115                 120                 125

Gln Asn Gln Leu Asn Arg Ser Thr Ala Ser Leu Ser Gln Glu Gln Glu
    130                 135                 140

Lys Arg Leu Ala Gln Thr Ile Gln Phe Thr Glu Lys Ile Asp Glu Ala
145                 150                 155                 160

Lys Glu Asn Lys Lys Phe Ile Gln Thr Ile Ala Ala Gly Ala Leu Gly
                165                 170                 175

Phe Phe Leu Tyr Met Ile Leu Ile Thr Tyr Ala Gly Val Thr Ala Gln
            180                 185                 190

Glu Val Ala Ser Glu Lys Gly Thr Lys Ile Met Glu Val Val Phe Ser
        195                 200                 205

Ser Ile Arg Ala Ser His Tyr Phe Tyr Ala Arg Met Met Ala Leu Phe
    210                 215                 220

Leu Val Ile Leu Thr His Ile Gly Ile Tyr Val Val Gly Gly Leu Ala
225                 230                 235                 240

Ala Val Leu Leu Phe Lys Asp Leu Pro Phe Leu Ala Gln Ser Gly Ile
                245                 250                 255

Leu Asp His Leu Gly Asp Ala Ile Ser Leu Asn Thr Leu Leu Phe Ile
            260                 265                 270

Leu Ile Ser Leu Phe Met Tyr Val Val Leu Ala Ala Phe Leu Gly Ser
        275                 280                 285

Met Val Ser Arg Pro Glu Asp Ser Gly Lys Ala Leu Ser Pro Leu Met
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    290                 295                 300

Ile Leu Ile Met Gly Gly Phe Phe Gly Val Thr Ala Leu Gly Ala Ala
305                 310                 315                 320

Gly Asp Asn Leu Leu Leu Lys Ile Gly Ser Tyr Ile Pro Phe Ile Ser
                325                 330                 335

Thr Phe Phe Met Pro Phe Arg Thr Ile Asn Asp Tyr Ala Gly Gly Ala
            340                 345                 350

Glu Ala Trp Ile Ser Leu Ala Ile Thr Val Ile Phe Ala Val Val Ala
        355                 360                 365

Thr Gly Phe Ile Gly Arg Met Tyr Ala Ser Leu Val Leu Gln Thr Asp
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accttgcatc ttgttgagga aaatatgttt ggcagtagca ttgccaatta tcgaaatagt 540
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<210> 4
<211> 374
<212> PRT
<213> Streptococcus pneumoniae

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             20                  25                  30

Val Ile Ser Ala Tyr Asn Glu Glu Lys Tyr Leu Pro Gly Leu Ile Glu
         35                  40                  45

Asp Leu Lys Asn Gln Thr Tyr Pro Lys Glu Asp Ile Glu Ile Leu Phe
     50                  55                  60

Ile Asn Ala Met Ser Thr Asp Gly Thr Thr Ala Ile Ile Gln Gln Phe
 65                  70                  75                  80

Ile Lys Glu Asp Thr Glu Phe Asn Ser Ile Arg Leu Tyr Asn Asn Pro
                 85                  90                  95

Lys Lys Asn Gln Ala Ser Gly Phe Asn Leu Gly Val Lys His Ser Val
            100                 105                 110

Gly Asp Leu Ile Leu Lys Ile Asp Ala His Ser Lys Val Thr Glu Thr
        115                 120                 125

Phe Val Met Asn Asn Val Ala Ile Ile Gln Gln Gly Glu Phe Val Cys
    130                 135                 140

Gly Gly Pro Arg Pro Thr Ile Val Glu Gly Lys Gly Lys Trp Ala Glu
145                 150                 155                 160

Thr Leu His Leu Val Glu Glu Asn Met Phe Gly Ser Ser Ile Ala Asn
                165                 170                 175

Tyr Arg Asn Ser Ser Glu Asp Arg Tyr Val Ser Ser Ile Phe His Gly
            180                 185                 190

Met Tyr Lys Arg Glu Val Phe Gln Lys Val Gly Leu Val Asn Glu Gln
        195                 200                 205

Leu Gly Arg Thr Glu Asp Asn Asp Ile His Tyr Arg Ile Arg Glu Tyr
    210                 215                 220

Gly Tyr Lys Ile Arg Tyr Ser Pro Ser Ile Leu Ser Tyr Gln Tyr Ile
225                 230                 235                 240

Arg Pro Thr Phe Lys Lys Met Leu His Gln Lys Tyr Ser Asn Gly Leu
                245                 250                 255

Trp Ile Gly Leu Thr Ser His Val Gln Phe Lys Cys Leu Ser Leu Phe
            260                 265                 270

His Tyr Val Pro Cys Leu Phe Val Leu Ser Leu Val Phe Ser Leu Ala
        275                 280                 285

Leu Leu Pro Ile Thr Phe Val Phe Ile Thr Leu Leu Leu Gly Ala Tyr
    290                 295                 300

Phe Leu Leu Leu Ser Leu Leu Thr Leu Leu Thr Leu Leu Lys His Lys
305                 310                 315                 320
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Asn Gly Phe Leu Ile Val Met Pro Phe Ile Leu Phe Ser Ile His Phe
                325                 330                 335

Ala Tyr Gly Leu Gly Thr Ile Val Gly Leu Ile Arg Gly Phe Lys Trp
            340                 345                 350

Lys Lys Glu Tyr Lys Arg Thr Ile Ile Tyr Leu Asp Lys Ile Ser Gln
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Ile Asn Gln Asn Met Leu
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aactctttga gagaagtagc tgctcaaaaa attatcagta ttactcgtgt ttctgacgtg 480
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acactaattg gttttttggc aggggtgatt ggaactagtg ttatagttct tcatcttgaa 600
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<210> 6
<211> 231
<212> PRT
<213> Streptococcus pneumoniae

<400> 6
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Lys Ser Leu Trp Lys Arg Lys Leu Met Ile Leu Ile Val Ala Leu Val
             20                  25                  30

Thr Gly Ala Gly Ala Phe Ala Tyr Ser Thr Phe Ile Val Lys Pro Glu
         35                  40                  45

Tyr Thr Ser Thr Thr Arg Ile Tyr Val Val Asn Arg Asn Gln Gly Asp
     50                  55                  60

Lys Pro Gly Leu Thr Asn Gln Asp Leu Gln Ala Gly Thr Tyr Leu Val
 65                  70                  75                  80

Lys Asp Tyr Arg Glu Ile Ile Leu Ser Gln Asp Val Leu Glu Glu Val
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```
                85                  90                  95

Val Ser Asp Leu Lys Leu Asp Leu Thr Pro Lys Gly Leu Ala Asn Lys
            100                 105                 110

Ile Lys Val Thr Val Pro Val Asp Thr Arg Ile Val Ser Ile Ser Val
        115                 120                 125

Asn Asp Arg Val Pro Glu Glu Ala Ser Arg Ile Ala Asn Ser Leu Arg
    130                 135                 140

Glu Val Ala Ala Gln Lys Ile Ile Ser Ile Thr Arg Val Ser Asp Val
145                 150                 155                 160

Thr Thr Leu Glu Glu Ala Arg Pro Ala Ile Ser Pro Ser Ser Pro Asn
                165                 170                 175

Ile Lys Arg Asn Thr Leu Ile Gly Phe Leu Ala Gly Val Ile Gly Thr
            180                 185                 190

Ser Val Ile Val Leu His Leu Glu Leu Leu Asp Thr Arg Val Lys Arg
        195                 200                 205

Pro Glu Asp Ile Glu Asn Thr Leu Gln Met Thr Leu Leu Gly Val Val
    210                 215                 220

Pro Asn Leu Gly Lys Leu Lys
225                 230
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<210> 7
<211> 555
<212> DNA
<213> Streptococcus pneumoniae

<400> 7

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<210> 8
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<213> Streptococcus pneumoniae

<400> 8

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  1               5                  10                  15
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Ala Leu Thr Val Val Asp Val Leu Arg Arg Ala Asn Ile Thr Cys Asp
             20                  25                  30

Met Val Gly Phe Glu Glu Gln Val Thr Gly Ser His Ala Ile Gln Val
         35                  40                  45

Arg Ala Asp His Val Phe Asp Gly Asp Leu Ser Asp Tyr Asp Met Ile
     50                  55                  60

Val Leu Pro Gly Gly Met Pro Gly Ser Ala His Leu Arg Asp Asn Gln
 65                  70                  75                  80

Thr Leu Ile Gln Glu Leu Gln Ser Phe Glu Gln Glu Gly Lys Lys Leu
                 85                  90                  95

Ala Ala Ile Cys Ala Ala Pro Ile Ala Leu Asn Gln Ala Glu Ile Leu
            100                 105                 110

Lys Asn Lys Arg Tyr Thr Cys Tyr Asp Gly Val Gln Glu Gln Ile Leu
        115                 120                 125

Asp Gly His Tyr Val Lys Glu Thr Val Val Val Asp Gly Gln Leu Thr
    130                 135                 140

Thr Ser Arg Gly Pro Ser Thr Ala Leu Ala Phe Ala Tyr Glu Leu Val
145                 150                 155                 160

Glu Gln Leu Gly Gly Asp Ala Glu Ser Leu Arg Thr Gly Met Leu Tyr
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Arg Asp Val Phe Gly Lys Asn Gln
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<211> 306
<212> DNA
<213> Streptococcus pneumoniae

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<212> PRT
<213> Streptococcus pneumoniae

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             20                  25                  30

Leu Glu Thr Thr Lys Lys Leu Pro Thr Thr Asn Glu Gln Leu Gln Ala
         35                  40                  45

Val Arg Leu Ser Gly Leu Val Asn Arg Glu Leu Leu Leu Asn Pro Lys
     50                  55                  60

His Pro Ala Pro Glu Leu Leu Asn Leu Ala Arg Phe Val Lys Arg Glu
 65                  70                  75                  80

Glu Ala Lys Tyr Arg Gly Thr Ala Thr Ser Ala Leu Met Tyr Glu Glu
                 85                  90                  95

Leu Phe Lys Met Leu
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<210> 11
<211> 945
<212> DNA
<213> Streptococcus pneumoniae

<400> 11
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gacgggatta agagcctact ttccatgtcc aaagaacctg tctatgatag ccgtacggaa 180
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<210> 12
<211> 314
<212> PRT
<213> Streptococcus pneumoniae

<400> 12
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             20                  25                  30
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Leu Leu Phe Val Gly Ile Gln Ser Asp Gly Ile Lys Ser Leu Leu Ser
         35                  40                  45

Met Ser Lys Glu Pro Val Tyr Asp Ser Arg Thr Glu Lys Leu Thr Phe
     50                  55                  60

Gly Lys Glu Val Glu Asn Leu Glu Ile Thr Leu His Gln His Thr Leu
 65                  70                  75                  80

Thr Ile Thr Asp Ser Phe Asp Asp Gln Ile His Ile Ser Tyr His Pro
                 85                  90                  95

Ser Leu Ser Ala His His Asp Leu Ile Thr Asn Gln Asn Asp Arg Thr
            100                 105                 110

Leu Ser Leu Thr Asp Lys Lys Leu Ser Glu Thr Pro Phe Leu Ser Ser
        115                 120                 125

Gly Ile Gly Gly Ile Leu His Ile Ala Ser Ser Tyr Ser Ser Arg Phe
    130                 135                 140

Glu Glu Val Ile Leu Arg Leu Pro Lys Gly Arg Thr Leu Lys Gly Ile
145                 150                 155                 160

Asn Ile Ser Ala Asn Arg Gly Gln Thr Thr Ile Ile Asn Ala Ser Leu
                165                 170                 175

Glu Asn Ala Thr Leu Asn Thr Asn Ser Tyr Ile Leu Arg Ile Glu Gly
            180                 185                 190

Ser Arg Ile Lys Asn Ser Lys Leu Thr Thr Pro Asn Ile Val Asn Ile
        195                 200                 205

Phe Asp Thr Val Leu Thr Asp Ser Gln Leu Glu Ser Thr Glu Asn His
    210                 215                 220

Phe His Ala Glu Asn Ile Gln Val His Gly Lys Val Glu Leu Thr Ala
225                 230                 235                 240

Lys Asp Tyr Leu Arg Ile Ile Leu Asp Gln Lys Glu Ser Gln Arg Ile
                245                 250                 255

Asn Trp Asp Ile Ser Ser Asn Tyr Gly Ser Ile Phe Gln Phe Thr Arg
            260                 265                 270

Glu Lys Pro Glu Ser Arg Gly Thr Glu Leu Ser Asn Pro Tyr Lys Thr
        275                 280                 285

Glu Lys Thr Asp Val Lys Asp Gln Leu Ile Ala Arg Ser Asp Asp Asn
    290                 295                 300

Ile Asp Leu Ile Ser Thr Pro Ser Arg Arg
305                 310
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<211> 879
<212> DNA
<213> Streptococcus pneumoniae

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ccaattgaaa aaaatactca gttagaggag gaagtccctc aagctgaagt cgaattggaa 180
agccagcaag aagagaaaat tgaagctcct gaagacagtg aagcgagaac agaaatagaa 240
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gtcactatag ctgaagagag ccaagaagct cttcctcagc aaaaagcaac cacgaaagag 360
ccacttctta tcagtaaatc tttagaaagt ccttatatcc ccgaccaagc tccaaaatct 420
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ggacatatag caagcattaa cagtcgcttc cctgagcagc tagctccttt aactcttttt 660
tctatcatct ctatcctagt agcgacaaca ctcttcttct tttcattcct cttgggtagt 720
ttcgttgtga gacgatttat ccaccaggaa aaggactgga cgctagacaa ggttctccaa 780
caatatagtc aactcttggc aattccaatc tcctcactgc tattgctagt ttctttgctt 840
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<210> 14
<211> 292
<212> PRT
<213> Streptococcus pneumoniae

<400> 14
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Lys Asn Lys Pro Glu Glu Gln Ala Gln Glu Val Ala Asp Lys Ala Glu
20 25 30

Glu Thr Ile Ala Asp Leu Asp Thr Pro Ile Glu Lys Asn Thr Gln Leu
35 40 45

Glu Glu Glu Val Pro Gln Ala Glu Val Glu Leu Glu Ser Gln Gln Glu
50 55 60

Glu Lys Ile Glu Ala Pro Glu Asp Ser Glu Ala Arg Thr Glu Ile Glu
65 70 75 80

Glu Lys Lys Ala Ser Asn Ser Thr Glu Glu Glu Pro Asp Leu Ser Lys
85 90 95

Glu Thr Glu Lys Val Thr Ile Ala Glu Glu Ser Gln Glu Ala Leu Pro
100 105 110

Gln Gln Lys Ala Thr Thr Lys Glu Pro Leu Leu Ile Ser Lys Ser Leu
115 120 125

Glu Ser Pro Tyr Ile Pro Asp Gln Ala Pro Lys Ser Arg Asp Lys Trp
130 135 140

Lys Glu Gln Val Leu Asp Phe Trp Ser Trp Leu Val Glu Ala Ile Lys

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145                 150                 155                 160

Ser Pro Thr Ser Lys Leu Glu Thr Ser Ile Thr His Ser Tyr Thr Ala
                165                 170                 175

Phe Leu Leu Leu Ile Leu Phe Ser Ala Ser Ser Phe Phe Phe Ser Ile
            180                 185                 190

Tyr His Ile Lys His Ala Tyr Tyr Gly His Ile Ala Ser Ile Asn Ser
        195                 200                 205

Arg Phe Pro Glu Gln Leu Ala Pro Leu Thr Leu Phe Ser Ile Ile Ser
    210                 215                 220

Ile Leu Val Ala Thr Thr Leu Phe Phe Phe Ser Phe Leu Leu Gly Ser
225                 230                 235                 240

Phe Val Val Arg Arg Phe Ile His Gln Glu Lys Asp Trp Thr Leu Asp
                245                 250                 255

Lys Val Leu Gln Gln Tyr Ser Gln Leu Leu Ala Ile Pro Ile Ser Ser
            260                 265                 270

Leu Leu Leu Leu Val Ser Leu Leu Ser Leu Ile Ala Tyr Asp Leu Gln
        275                 280                 285

Pro Ser Cys Val
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<210> 15
<211> 990
<212> DNA
<213> Streptococcus pneumoniae

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ctactttcca tgtccaaaga acctgtctat gatagccgta cggaaaagct aacctttggc 240
aaggaagtcg aaaacctaga aattactctc caccaacaca cgctcaccat cacagactct 300
ttcgatgatc aaatccacat ttcttaccat ccatctcttt ctgctcacca tgatcttatc 360
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ctctcttctg gaattggtgg gattcttcat atcgcaagta gctactctag tcgttttgaa 480
gaagttattc tccgactacc aaaagggaga actctaaaag ggatcaacat ctcagccaat 540
cgcggacaaa ccaccatcat aaatgctagc cttgaaaatg cgaccctcaa tacaaacagc 600
tatatcctcc gaattgaagg aagtcgtatc aaaaacagta aactcacaac gcccaatatc 660
gttaatatct ttgatacagt tcttacagat agtcagctag agtcaacaga gaatcacttc 720
cacgctgaaa atatccaagt ccatggcaag gttgaactga ctgccaaaga ttatctcaga 780
atcatcctag accagaaaga aagccaacga attaactggg acatctcaag caactatggt 840
tctatcttcc aattcacaag agaaaagcct gaatcaagag gtacggaatt aagcaaccct 900
tacaaaactg aaaaaaccga tgtcaaggat caactcattg cgagatctga tgataatatt 960
gatctaatat ccacaccaag cagacgttga   990

<210> 16

<211> 329
<212> PRT
<213> Streptococcus pneumoniae

<400> 16
Met Gln Leu Ala Ser Ser Val Tyr Ser Leu Phe Val Trp Tyr Asn Leu
1 5 10 15

Phe Leu Lys Lys Glu Arg Glu Val Ile Ser Met Arg Lys Trp Thr Lys
20 25 30

Gly Phe Leu Ile Phe Gly Val Val Thr Thr Val Ile Gly Phe Ile Leu
35 40 45

Leu Phe Val Gly Ile Gln Ser Asp Gly Ile Lys Ser Leu Leu Ser Met
50 55 60

Ser Lys Glu Pro Val Tyr Asp Ser Arg Thr Glu Lys Leu Thr Phe Gly
65 70 75 80

Lys Glu Val Glu Asn Leu Glu Ile Thr Leu His Gln His Thr Leu Thr
85 90 95

Ile Thr Asp Ser Phe Asp Asp Gln Ile His Ile Ser Tyr His Pro Ser
100 105 110

Leu Ser Ala His His Asp Leu Ile Thr Asn Gln Asn Asp Arg Thr Leu
115 120 125

Ser Leu Thr Asp Lys Lys Leu Ser Glu Thr Pro Phe Leu Ser Ser Gly
130 135 140

Ile Gly Gly Ile Leu His Ile Ala Ser Ser Tyr Ser Ser Arg Phe Glu
145 150 155 160

Glu Val Ile Leu Arg Leu Pro Lys Gly Arg Thr Leu Lys Gly Ile Asn
165 170 175

Ile Ser Ala Asn Arg Gly Gln Thr Thr Ile Ile Asn Ala Ser Leu Glu
180 185 190

Asn Ala Thr Leu Asn Thr Asn Ser Tyr Ile Leu Arg Ile Glu Gly Ser
195 200 205

Arg Ile Lys Asn Ser Lys Leu Thr Thr Pro Asn Ile Val Asn Ile Phe
210 215 220

Asp Thr Val Leu Thr Asp Ser Gln Leu Glu Ser Thr Glu Asn His Phe
225 230 235 240

His Ala Glu Asn Ile Gln Val His Gly Lys Val Glu Leu Thr Ala Lys
245 250 255

Asp Tyr Leu Arg Ile Ile Leu Asp Gln Lys Glu Ser Gln Arg Ile Asn
260 265 270

Trp Asp Ile Ser Ser Asn Tyr Gly Ser Ile Phe Gln Phe Thr Arg Glu

```
        275                 280                 285

Lys Pro Glu Ser Arg Gly Thr Glu Leu Ser Asn Pro Tyr Lys Thr Glu
    290                 295                 300

Lys Thr Asp Val Lys Asp Gln Leu Ile Ala Arg Ser Asp Asp Asn Ile
305                 310                 315                 320

Asp Leu Ile Ser Thr Pro Ser Arg Arg
                325
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<210> 17
<211> 79
<212> DNA
<213> Streptococcus pneumoniae

<400> 17
atgatatgta aaatgaagca gggagggagc agggcgtgct ggggatggag agtgggggag 60
ggacgctgct attttaatc 79

<210> 18
<211> 26
<212> PRT
<213> Streptòcoccus pneumoniae

<400> 18

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Met Ile Cys Lys Met Lys Gln Gly Gly Ser Arg Ala Cys Trp Gly Trp
  1               5                  10                  15

Arg Val Gly Glu Gly Arg Cys Tyr Phe Asn
             20                  25
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<210> 19
<211> 715
<212> DNA
<213> Streptococcus pneumoniae

<400> 19
cgataaagag gccttgagta atctcaattt gcagattgaa aatggagaga ttatgggctt 60
gattggtcat aatggggctg gaaaatcgac cactataaaa tccctagtca gtatcatttc 120
acccagcagt ggtcgtattt tggtagacgg tcaggagtta tcggaaaatc gcttggctat 180
taaacgaaag attggctacg tagcagactc gcctgactta tttttacgct taacggccaa 240
tgaattttgg gaattgatcg cctcatccta tgatctgagt agatctgact tggaggctag 300
tctagctagg ctattgaacg tttttgattt tgctgaaaat cgctatcagg ttattgaaac 360
tctttctcac ggaatgcgtc agaaagtctt tgtcatcgga gcactcttgt ctgatcccga 420
tatttgggtt ttggacgaac ccttgactgg tttggatccc caggctgcct ttgatttgaa 480
acagatgatg aaggaacatg cacaaaaagg gaagacagtc ttgttttcaa ctcatgtcct 540
agaggtggca gagcaagtct gtgatcggat tgccattttg aaaaaggggc atttgattta 600
ttgtggtaag gtagaggact tgaggaaaga ccacccagac cagtctttgg aaagtatcta 660
ccttagtctt gctggtagaa aagaggaggt tgcggatgcg tctcaaggtc attaa 715

<210> 20
<211> 237
<212> PRT
<213> Streptococcus pneumoniae

<400> 20
Asp Lys Glu Ala Leu Ser Asn Leu Asn Leu Gln Ile Glu Asn Gly Glu
1 5 10 15

Ile Met Gly Leu Ile Gly His Asn Gly Ala Gly Lys Ser Thr Thr Ile
20 25 30

Lys Ser Leu Val Ser Ile Ile Ser Pro Ser Ser Gly Arg Ile Leu Val
35 40 45

Asp Gly Gln Glu Leu Ser Glu Asn Arg Leu Ala Ile Lys Arg Lys Ile
50 55 60

Gly Tyr Val Ala Asp Ser Pro Asp Leu Phe Leu Arg Leu Thr Ala Asn
65 70 75 80

Glu Phe Trp Glu Leu Ile Ala Ser Ser Tyr Asp Leu Ser Arg Ser Asp
85 90 95

Leu Glu Ala Ser Leu Ala Arg Leu Leu Asn Val Phe Asp Phe Ala Glu
100 105 110

Asn Arg Tyr Gln Val Ile Glu Thr Leu Ser His Gly Met Arg Gln Lys
115 120 125

Val Phe Val Ile Gly Ala Leu Leu Ser Asp Pro Asp Ile Trp Val Leu
130 135 140

Asp Glu Pro Leu Thr Gly Leu Asp Pro Gln Ala Ala Phe Asp Leu Lys
145 150 155 160

Gln Met Met Lys Glu His Ala Gln Lys Gly Lys Thr Val Leu Phe Ser
165 170 175

Thr His Val Leu Glu Val Ala Glu Gln Val Cys Asp Arg Ile Ala Ile
180 185 190

Leu Lys Lys Gly His Leu Ile Tyr Cys Gly Lys Val Glu Asp Leu Arg
195 200 205

Lys Asp His Pro Asp Gln Ser Leu Glu Ser Ile Tyr Leu Ser Leu Ala
210 215 220

Gly Arg Lys Glu Glu Val Ala Asp Ala Ser Gln Gly His
225 230 235

<210> 21
<211> 360
<212> DNA
<213> Streptococcus pneumoniae

<400> 21
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agacctatga tggttccgac gatagagatt aaaagagtga taccagcacc acgcaagagt 120
tgttgccagt tttcagaaag aattttagca acttggctaa agaaactact gctagtctct 180
tcagttgttg tagcttcggc aggttgttcc ttgatcatac gatccatcaa ggcaacttgg 240
tcatcttttg aaatggtttc aatgctggca ttgatttggc taatacgatt gtcattttta 300
cgaagcccga tagcgatagc tgtatcttct tccccagttt tgaaaccagg ttctacttga 360

<210> 22
<211> 119
<212> PRT
<213> Streptococcus pneumoniae

<400> 22
Met Ala Leu Phe Ser Glu Arg Gly Ala Val Arg Lys Thr Pro Met Ala
  1   5   10   15

Ser Pro Ile Met Arg Pro Met Met Val Pro Thr Ile Glu Ile Lys Arg
             20   25   30

Val Ile Pro Ala Pro Arg Lys Ser Cys Cys Gln Phe Ser Glu Arg Ile
         35   40   45

Leu Ala Thr Trp Leu Lys Lys Leu Leu Leu Val Ser Ser Val Val Val
     50   55   60

Ala Ser Ala Gly Cys Ser Leu Ile Ile Arg Ser Ile Lys Ala Thr Trp
 65   70   75   80

Ser Ser Phe Glu Met Val Ser Met Leu Ala Leu Ile Trp Leu Ile Arg
                 85   90   95

Leu Ser Phe Leu Arg Ser Pro Ile Ala Ile Ala Val Ser Ser Ser Pro
            100   105   110

Val Leu Lys Pro Gly Ser Thr
        115

<210> 23
<211> 1455
<212> DNA
<213> Streptococcus pneumoniae

<400> 23
atgaaattta gtaaaaaata tatagcagct ggatcagctg ttatcgtatc cttgagtcta 60
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tatgtggatg gcagccagtc aagtcagaaa agtgaaaact tgacaccaga ccaggttagc 180
cagaaagaag gaattcaggc tgagcaaatt gtaatcaaaa ttacagatca gggctatgta 240
acgtcacacg gtgaccacta tcattactat aatgggaaag ttccttatga tgccctcttt 300
agtgaagaac tcttgatgaa ggatccaaac tatcaactta aagacgctga tattgtcaat 360
gaagtcaagg gtggttatat catcaaggtc gatggaaaat attatgtcta cctgaaagat 420
gcagctcatg ctgataatgt tcgaactaaa gatgaaatca atcgtcaaaa acaagaacat 480
gtcaaagata atgagaaggt taactctaat gttgctgtag caaggtctca gggacgatat 540

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gaattagcag cagctaaagc acatctggct ggaaaaaata tgcaaccgag tcagttaagc 720
tattcttcaa cagctagtga caataacacg caatctgtag caaaaggatc aactagcaag 780
ccagcaaata aatctgaaaa tctccagagt cttttgaagg aactctatga ttcacctagc 840
gcccaacgtt acagtgaatc agatggcctg gtctttgacc ctgctaagat tatcagtcgt 900
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cattacattc caaaatcaaa tcaaattggg caaccgactc ttccaaacaa tagtctagca 1260
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cacggagacc acaatcatta tttcttcaag aaggacttga cagaagagca aattaaggtg 1440
cgcaaaaaca tttag                                                  1455
```

<210> 24
<211> 484
<212> PRT
<213> Streptococcus pneumoniae

<400> 24

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Met Lys Phe Ser Lys Lys Tyr Ile Ala Ala Gly Ser Ala Val Ile Val
  1               5                  10                  15

Ser Leu Ser Leu Cys Ala Tyr Ala Leu Asn Gln His Arg Ser Gln Glu
             20                  25                  30

Asn Lys Asp Asn Asn Arg Val Ser Tyr Val Asp Gly Ser Gln Ser Ser
         35                  40                  45

Gln Lys Ser Glu Asn Leu Thr Pro Asp Gln Val Ser Gln Lys Glu Gly
     50                  55                  60

Ile Gln Ala Glu Gln Ile Val Ile Lys Ile Thr Asp Gln Gly Tyr Val
 65                  70                  75                  80

Thr Ser His Gly Asp His Tyr His Tyr Tyr Asn Gly Lys Val Pro Tyr
                 85                  90                  95

Asp Ala Leu Phe Ser Glu Glu Leu Leu Met Lys Asp Pro Asn Tyr Gln
            100                 105                 110

Leu Lys Asp Ala Asp Ile Val Asn Glu Val Lys Gly Gly Tyr Ile Ile
        115                 120                 125

Lys Val Asp Gly Lys Tyr Tyr Val Tyr Leu Lys Asp Ala Ala His Ala
    130                 135                 140

Asp Asn Val Arg Thr Lys Asp Glu Ile Asn Arg Gln Lys Gln Glu His
145                 150                 155                 160

Val Lys Asp Asn Glu Lys Val Asn Ser Asn Val Ala Val Ala Arg Ser
                165                 170                 175
```

```
Gln Gly Arg Tyr Thr Thr Asn Asp Gly Tyr Val Phe Asn Pro Ala Asp
            180                 185                 190

Ile Ile Glu Asp Thr Gly Asn Ala Tyr Ile Val Pro His Gly Gly His
        195                 200                 205

Tyr His Tyr Ile Pro Lys Ser Asp Leu Ser Ala Ser Glu Leu Ala Ala
    210                 215                 220

Ala Lys Ala His Leu Ala Gly Lys Asn Met Gln Pro Ser Gln Leu Ser
225                 230                 235                 240

Tyr Ser Ser Thr Ala Ser Asp Asn Asn Thr Gln Ser Val Ala Lys Gly
                245                 250                 255

Ser Thr Ser Lys Pro Ala Asn Lys Ser Glu Asn Leu Gln Ser Leu Leu
            260                 265                 270

Lys Glu Leu Tyr Asp Ser Pro Ser Ala Gln Arg Tyr Ser Glu Ser Asp
        275                 280                 285

Gly Leu Val Phe Asp Pro Ala Lys Ile Ile Ser Arg Thr Pro Asn Gly
    290                 295                 300

Val Ala Ile Pro His Gly Asp His Tyr His Phe Ile Pro Tyr Ser Lys
305                 310                 315                 320

Leu Ser Ala Leu Glu Glu Lys Ile Ala Arg Met Val Pro Ile Ser Gly
                325                 330                 335

Thr Gly Ser Thr Val Ser Thr Asn Ala Lys Pro Asn Glu Val Val Ser
            340                 345                 350

Ser Leu Gly Ser Leu Ser Ser Asn Pro Ser Ser Leu Thr Thr Ser Lys
        355                 360                 365

Glu Leu Ser Ser Ala Ser Asp Gly Tyr Ile Phe Asn Pro Lys Asp Ile
    370                 375                 380

Val Glu Glu Thr Ala Thr Ala Tyr Ile Val Arg His Gly Asp His Phe
385                 390                 395                 400

His Tyr Ile Pro Lys Ser Asn Gln Ile Gly Gln Pro Thr Leu Pro Asn
                405                 410                 415

Asn Ser Leu Ala Thr Pro Ser Pro Ser Leu Pro Ile Asn Pro Gly Thr
            420                 425                 430

Ser His Glu Lys His Glu Glu Asp Gly Tyr Gly Phe Asp Ala Asn Arg
        435                 440                 445

Ile Ile Ala Glu Asp Glu Ser Gly Phe Val Met Ser His Gly Asp His
    450                 455                 460

Asn His Tyr Phe Phe Lys Lys Asp Leu Thr Glu Glu Gln Ile Lys Val
465                 470                 475                 480
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Arg Lys Asn Ile

<210> 25
<211> 840
<212> DNA
<213> Streptococcus pneumoniae

<400> 25
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gcagctttgt cggatgtttc tttgacgatt gaagatggct cttatacagc tttaattggg 120
cacacaggta gtggtaaatc aactatttta caactcttaa atggtttatt ggtgccaagt 180
caagggagtg tgagggtttt tgatacctta atcacctcga cttctaaaaa taaagatatt 240
cgtcaaatta gaaaacaggt tggcttggta tttcagtttg ctgaaaatca gatttttgaa 300
gaaacggttt tgaaggacgt tgcttttgga ccgcaaaatt ttggagtttc tgaagaagat 360
gctgtgaaga ctgcgcgtga gaaactggct ctggttggaa ttgatgaatc acttttttgat 420
cgtagtccgt ttgagctgtc agggggacaa atgagacgtg ttgccattgc aggcatactt 480
gccatggagc cagctatatt agtcttagat gagccaacag ctggtctaga tcctctaggg 540
agaaaagagt tgatgaccct gttcaaaaaa ctccaccagt cagggatgac catcgtcttg 600
gtaacgcatt tgatggatga tgttgctgaa tatgcgaatc aagtctatgt aatggaaaag 660
ggacgtttag taaaggggggg caaaccaagt gatgtctttc aagacgttgt ttttatggaa 720
gaagttcagt tgggagtacc taaaattacg gccttttgta aacgattggc tgatagaggc 780
gtgtcattta aacgattacc gattaagata gaggagttca aggagtcgct aaatggatag 840

<210> 26
<211> 279
<212> PRT
<213> Streptococcus pneumoniae

<400> 26
Met Gly Ile Ala Leu Glu Asn Val Asn Phe Thr Tyr Gln Glu Gly Thr
1 5 10 15

Pro Leu Ala Ser Ala Ala Leu Ser Asp Val Ser Leu Thr Ile Glu Asp
20 25 30

Gly Ser Tyr Thr Ala Leu Ile Gly His Thr Gly Ser Gly Lys Ser Thr
35 40 45

Ile Leu Gln Leu Leu Asn Gly Leu Leu Val Pro Ser Gln Gly Ser Val
50 55 60

Arg Val Phe Asp Thr Leu Ile Thr Ser Thr Ser Lys Asn Lys Asp Ile
65 70 75 80

Arg Gln Ile Arg Lys Gln Val Gly Leu Val Phe Gln Phe Ala Glu Asn
85 90 95

Gln Ile Phe Glu Glu Thr Val Leu Lys Asp Val Ala Phe Gly Pro Gln
100 105 110

Asn Phe Gly Val Ser Glu Glu Asp Ala Val Lys Thr Ala Arg Glu Lys
115 120 125

```
Leu Ala Leu Val Gly Ile Asp Glu Ser Leu Phe Asp Arg Ser Pro Phe
    130                 135                 140

Glu Leu Ser Gly Gly Gln Met Arg Arg Val Ala Ile Ala Gly Ile Leu
145                 150                 155                 160

Ala Met Glu Pro Ala Ile Leu Val Leu Asp Glu Pro Thr Ala Gly Leu
                165                 170                 175

Asp Pro Leu Gly Arg Lys Glu Leu Met Thr Leu Phe Lys Lys Leu His
            180                 185                 190

Gln Ser Gly Met Thr Ile Val Leu Val Thr His Leu Met Asp Asp Val
        195                 200                 205

Ala Glu Tyr Ala Asn Gln Val Tyr Val Met Glu Lys Gly Arg Leu Val
    210                 215                 220

Lys Gly Gly Lys Pro Ser Asp Val Phe Gln Asp Val Val Phe Met Glu
225                 230                 235                 240

Glu Val Gln Leu Gly Val Pro Lys Ile Thr Ala Phe Cys Lys Arg Leu
                245                 250                 255

Ala Asp Arg Gly Val Ser Phe Lys Arg Leu Pro Ile Lys Ile Glu Glu
            260                 265                 270

Phe Lys Glu Ser Leu Asn Gly
        275
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<210> 27
<211> 6360
<212> DNA
<213> Streptococcus pneumoniae

<400> 27
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gaaaaagtag cagaaaataa agagaaacat gaaaatatcc atagtgctat ggaaacttca 120
caggatttta aagagaagaa aacagcagtc attaaggaaa aagaagttgt tagtaaaaat 180
cctgtgatag acaataacac tagcaatgaa gaagcaaaaa tcaaagaaga aaattccaat 240
aaatcccaag gagattatac ggactcattt gtgaataaaa acacagaaaa tcccaaaaaa 300
gaagataaag ttgtctatat tgctgaattt aaagataaag aatctggaga aaaagcaatc 360
aaggaactat ccagtcttaa gaatacaaaa gttttatata cttatgatag aatttttaac 420
ggtagtgcca tagaaacaac tccagataac ttggacaaaa ttaaacaaat agaaggtatt 480
tcatcggttg aaagggcaca aaaagtccaa cccatgatga atcatgccag aaaggaaatt 540
ggagttgagg aagctattga ttacctaaag tctatcaatg ctccgtttgg gaaaaatttt 600
gatggtagag gtatggtcat ttcaaatatc gatactggaa cagattatag acataaggct 660
atgagaatcg atgatgatgc caaagcctca atgagattta aaaaagaaga cttaaaaggc 720
actgataaaa attattggtt gagtgataaa atccctcatg cgttcaatta ttataatggt 780
ggcaaaatca ctgtagaaaa atatgatgat ggaagggatt attttgaccc acatgggatg 840
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<210> 28
<211> 2119
<212> PRT
<213> Streptococcus pneumoniae

<400> 28
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20 25 30

Ile His Ser Ala Met Glu Thr Ser Gln Asp Phe Lys Glu Lys Lys Thr
35 40 45

Ala Val Ile Lys Glu Lys Glu Val Val Ser Lys Asn Pro Val Ile Asp
50 55 60

Asn Asn Thr Ser Asn Glu Glu Ala Lys Ile Lys Glu Glu Asn Ser Asn
65 70 75 80

Lys Ser Gln Gly Asp Tyr Thr Asp Ser Phe Val Asn Lys Asn Thr Glu
85 90 95

Asn Pro Lys Lys Glu Asp Lys Val Val Tyr Ile Ala Glu Phe Lys Asp

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            100                 105                 110

Lys Glu Ser Gly Glu Lys Ala Ile Lys Glu Leu Ser Ser Leu Lys Asn
        115                 120                 125

Thr Lys Val Leu Tyr Thr Tyr Asp Arg Ile Phe Asn Gly Ser Ala Ile
    130                 135                 140

Glu Thr Thr Pro Asp Asn Leu Asp Lys Ile Lys Gln Ile Glu Gly Ile
145                 150                 155                 160

Ser Ser Val Glu Arg Ala Gln Lys Val Gln Pro Met Met Asn His Ala
                165                 170                 175

Arg Lys Glu Ile Gly Val Glu Glu Ala Ile Asp Tyr Leu Lys Ser Ile
            180                 185                 190

Asn Ala Pro Phe Gly Lys Asn Phe Asp Gly Arg Gly Met Val Ile Ser
        195                 200                 205

Asn Ile Asp Thr Gly Thr Asp Tyr Arg His Lys Ala Met Arg Ile Asp
    210                 215                 220

Asp Asp Ala Lys Ala Ser Met Arg Phe Lys Lys Glu Asp Leu Lys Gly
225                 230                 235                 240

Thr Asp Lys Asn Tyr Trp Leu Ser Asp Lys Ile Pro His Ala Phe Asn
                245                 250                 255

Tyr Tyr Asn Gly Gly Lys Ile Thr Val Glu Lys Tyr Asp Asp Gly Arg
            260                 265                 270

Asp Tyr Phe Asp Pro His Gly Met His Ile Ala Gly Ile Leu Ala Gly
        275                 280                 285

Asn Asp Thr Glu Gln Asp Ile Lys Asn Phe Asn Gly Ile Asp Gly Ile
    290                 295                 300

Ala Pro Asn Ala Gln Ile Phe Ser Tyr Lys Met Tyr Ser Asp Ala Gly
305                 310                 315                 320

Ser Gly Phe Ala Gly Asp Glu Thr Met Phe His Ala Ile Glu Asp Ser
                325                 330                 335

Ile Lys His Asn Val Asp Val Val Ser Val Ser Ser Gly Phe Thr Gly
            340                 345                 350

Thr Gly Leu Val Gly Glu Lys Tyr Trp Gln Ala Ile Arg Ala Leu Arg
        355                 360                 365

Lys Ala Gly Ile Pro Met Val Val Ala Thr Gly Asn Tyr Ala Thr Ser
    370                 375                 380

Ala Ser Ser Ser Ser Trp Asp Leu Val Ala Asn Asn His Leu Lys Met
385                 390                 395                 400

Thr Asp Thr Gly Asn Val Thr Arg Thr Ala Ala His Glu Asp Ala Ile
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405 410 415

Ala Val Ala Ser Ala Lys Asn Gln Thr Val Glu Phe Asp Lys Val Asn
420 425 430

Ile Gly Gly Glu Ser Phe Lys Tyr Arg Asn Ile Gly Ala Phe Phe Asp
435 440 445

Lys Ser Lys Ile Thr Thr Asn Glu Asp Gly Thr Lys Ala Pro Ser Lys
450 455 460

Leu Lys Phe Val Tyr Ile Gly Lys Gly Gln Asp Gln Asp Leu Ile Gly
465 470 475 480

Leu Asp Leu Arg Gly Lys Ile Ala Val Met Asp Arg Ile Tyr Thr Lys
485 490 495

Asp Leu Lys Asn Ala Phe Lys Lys Ala Met Asp Lys Gly Ala Arg Ala
500 505 510

Ile Met Val Val Asn Thr Val Asn Tyr Tyr Asn Arg Asp Asn Trp Thr
515 520 525

Glu Leu Pro Ala Met Gly Tyr Glu Ala Asp Glu Gly Thr Lys Ser Gln
530 535 540

Val Phe Ser Ile Ser Gly Asp Asp Gly Val Lys Leu Trp Asn Met Ile
545 550 555 560

Asn Pro Asp Lys Lys Thr Glu Val Lys Arg Asn Asn Lys Glu Asp Phe
565 570 575

Lys Asp Lys Leu Glu Gln Tyr Tyr Pro Ile Asp Met Glu Ser Phe Asn
580 585 590

Ser Asn Lys Pro Asn Val Gly Asp Glu Lys Glu Ile Asp Phe Lys Phe
595 600 605

Ala Pro Asp Thr Asp Lys Glu Leu Tyr Lys Glu Asp Ile Ile Val Pro
610 615 620

Ala Gly Ser Thr Ser Trp Gly Pro Arg Ile Asp Leu Leu Leu Lys Pro
625 630 635 640

Asp Val Ser Ala Pro Gly Lys Asn Ile Lys Ser Thr Leu Asn Val Ile
645 650 655

Asn Gly Lys Ser Thr Tyr Gly Tyr Met Ser Gly Thr Ser Met Ala Thr
660 665 670

Pro Ile Val Ala Ala Ser Thr Val Leu Ile Arg Pro Lys Leu Lys Glu
675 680 685

Met Leu Glu Arg Pro Val Leu Lys Asn Leu Lys Gly Asp Asp Lys Ile
690 695 700

Asp Leu Thr Ser Leu Thr Lys Ile Ala Leu Gln Asn Thr Ala Arg Pro

705 710 715 720

Met Met Asp Ala Thr Ser Trp Lys Glu Lys Ser Gln Tyr Phe Ala Ser
725 730 735

Pro Arg Gln Gln Gly Ala Gly Leu Ile Asn Val Ala Asn Ala Leu Arg
740 745 750

Asn Glu Val Val Ala Thr Phe Lys Asn Thr Asp Ser Lys Gly Leu Val
755 760 765

Asn Ser Tyr Gly Ser Ile Ser Leu Lys Glu Ile Lys Gly Asp Lys Lys
770 775 780

Tyr Phe Thr Ile Lys Leu His Asn Thr Ser Asn Arg Pro Leu Thr Phe
785 790 795 800

Lys Val Ser Ala Ser Ala Ile Thr Thr Asp Ser Leu Thr Asp Arg Leu
805 810 815

Lys Leu Asp Glu Thr Tyr Lys Asp Glu Lys Ser Pro Asp Gly Lys Gln
820 825 830

Ile Val Pro Glu Ile His Pro Glu Lys Val Lys Gly Ala Asn Ile Thr
835 840 845

Phe Glu His Asp Thr Phe Thr Ile Gly Ala Asn Ser Ser Phe Asp Leu
850 855 860

Asn Ala Val Ile Asn Val Gly Glu Ala Lys Asn Lys Asn Lys Phe Val
865 870 875 880

Glu Ser Phe Ile His Phe Glu Ser Val Glu Ala Met Glu Ala Leu Asn
885 890 895

Ser Ser Gly Lys Lys Ile Asn Phe Gln Pro Ser Leu Ser Met Pro Leu
900 905 910

Met Gly Phe Ala Gly Asn Trp Asn His Glu Pro Ile Leu Asp Lys Trp
915 920 925

Ala Trp Glu Glu Gly Ser Arg Ser Lys Thr Leu Gly Gly Tyr Asp Asp
930 935 940

Asp Gly Lys Pro Lys Ile Pro Gly Thr Leu Asn Lys Gly Ile Gly Gly
945 950 955 960

Glu His Gly Ile Asp Lys Phe Asn Pro Ala Gly Val Ile Gln Asn Arg
965 970 975

Lys Asp Lys Asn Thr Thr Ser Leu Asp Gln Asn Pro Glu Leu Phe Ala
980 985 990

Phe Asn Asn Glu Gly Ile Asn Ala Pro Ser Ser Ser Gly Ser Lys Ile
995 1000 1005

Ala Asn Ile Tyr Pro Leu Asp Ser Asn Gly Asn Pro Gln Asp Ala Gln

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   1010                1015                1020

Leu Glu Arg Gly Leu Thr Pro Ser Pro Leu Val Leu Arg Ser Ala Glu
1025                1030                1035                1040

Glu Gly Leu Ile Ser Ile Val Asn Thr Asn Lys Glu Gly Glu Asn Gln
                1045                1050                1055

Arg Asp Leu Lys Val Ile Ser Arg Glu His Phe Ile Arg Gly Ile Leu
            1060                1065                1070

Asn Ser Lys Ser Asn Asp Ala Lys Gly Ile Lys Ser Ser Lys Leu Lys
        1075                1080                1085

Val Trp Gly Asp Leu Lys Trp Asp Gly Leu Ile Tyr Asn Pro Arg Gly
    1090                1095                1100

Arg Glu Glu Asn Ala Pro Glu Ser Lys Asp Asn Gln Asp Pro Ala Thr
1105                1110                1115                1120

Lys Ile Arg Gly Gln Phe Glu Pro Ile Ala Glu Gly Gln Tyr Phe Tyr
                1125                1130                1135

Lys Phe Lys Tyr Arg Leu Thr Lys Asp Tyr Pro Trp Gln Val Ser Tyr
            1140                1145                1150

Ile Pro Val Lys Ile Asp Asn Thr Ala Pro Lys Ile Val Ser Val Asp
        1155                1160                1165

Phe Ser Asn Pro Glu Lys Ile Lys Leu Ile Thr Lys Asp Thr Tyr His
    1170                1175                1180

Lys Val Lys Asp Gln Tyr Lys Asn Glu Thr Leu Phe Ala Arg Asp Gln
1185                1190                1195                1200

Lys Glu His Pro Glu Lys Phe Asp Glu Ile Ala Asn Glu Val Trp Tyr
                1205                1210                1215

Ala Gly Ala Ala Leu Val Asn Glu Asp Gly Glu Val Glu Lys Asn Leu
            1220                1225                1230

Glu Val Thr Tyr Ala Gly Glu Gly Gln Gly Arg Asn Arg Lys Leu Asp
        1235                1240                1245

Lys Asp Gly Asn Thr Ile Tyr Glu Ile Lys Gly Ala Gly Asp Leu Arg
    1250                1255                1260

Gly Lys Ile Ile Glu Val Ile Ala Leu Asp Gly Ser Ser Asn Phe Thr
1265                1270                1275                1280

Lys Ile His Arg Ile Lys Phe Ala Asn Gln Ala Asp Glu Lys Gly Met
                1285                1290                1295

Ile Ser Tyr Tyr Leu Val Asp Pro Asp Gln Asp Ser Ser Lys Tyr Gln
            1300                1305                1310

Lys Leu Gly Glu Ile Ala Glu Ser Lys Phe Lys Asn Leu Gly Asn Gly
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       1315                1320                1325

Lys Glu Gly Ser Leu Lys Lys Asp Thr Thr Gly Val Glu His His His
   1330                1335                1340

Gln Glu Asn Glu Glu Ser Ile Lys Glu Lys Ser Ser Phe Thr Ile Asp
1345                1350                1355                1360

Arg Asn Ile Ser Thr Ile Arg Asp Phe Glu Asn Lys Asp Leu Lys Lys
               1365                1370                1375

Leu Ile Lys Lys Lys Phe Arg Glu Val Asp Asp Phe Thr Ser Glu Thr
           1380                1385                1390

Gly Lys Arg Met Glu Glu Tyr Asp Tyr Lys Tyr Asp Asp Lys Gly Asn
       1395                1400                1405

Ile Ile Ala Tyr Asp Asp Gly Thr Asp Leu Glu Tyr Glu Thr Glu Lys
   1410                1415                1420

Leu Asp Glu Ile Lys Ser Lys Ile Tyr Gly Val Leu Ser Pro Ser Lys
1425                1430                1435                1440

Asp Gly His Phe Glu Ile Leu Gly Lys Ile Ser Asn Val Ser Lys Asn
               1445                1450                1455

Ala Lys Val Tyr Tyr Gly Asn Asn Tyr Lys Ser Ile Glu Ile Lys Ala
           1460                1465                1470

Thr Lys Tyr Asp Phe His Ser Lys Thr Met Thr Phe Asp Leu Tyr Ala
       1475                1480                1485

Asn Ile Asn Asp Ile Val Asp Gly Leu Ala Phe Ala Gly Asp Met Arg
   1490                1495                1500

Leu Phe Val Lys Asp Asn Asp Gln Lys Lys Ala Glu Ile Lys Ile Arg
1505                1510                1515                1520

Met Pro Glu Lys Ile Lys Glu Thr Lys Ser Glu Tyr Pro Tyr Val Ser
               1525                1530                1535

Ser Tyr Gly Asn Val Ile Glu Leu Gly Glu Gly Asp Leu Ser Lys Asn
           1540                1545                1550

Lys Pro Asp Asn Leu Thr Lys Met Glu Ser Gly Lys Ile Tyr Ser Asp
       1555                1560                1565

Ser Glu Lys Gln Gln Tyr Leu Leu Lys Asp Asn Ile Ile Leu Arg Lys
   1570                1575                1580

Gly Tyr Ala Leu Lys Val Thr Thr Tyr Asn Pro Gly Lys Thr Asp Met
1585                1590                1595                1600

Leu Glu Gly Asn Gly Val Tyr Ser Lys Glu Asp Ile Ala Lys Ile Gln
               1605                1610                1615

Lys Ala Asn Pro Asn Leu Arg Ala Leu Ser Glu Thr Thr Ile Tyr Ala
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          1620                1625                1630

Asp Ser Arg Asn Val Glu Asp Gly Arg Ser Thr Gln Ser Val Leu Met
       1635                1640                1645

Ser Ala Leu Asp Gly Phe Asn Ile Ile Arg Tyr Gln Val Phe Thr Phe
   1650                1655                1660

Lys Met Asn Asp Lys Gly Glu Ala Ile Asp Lys Asp Gly Asn Leu Val
1665                1670                1675                1680

Thr Asp Ser Ser Lys Leu Val Leu Phe Gly Lys Asp Asp Lys Glu Tyr
               1685                1690                1695

Thr Gly Glu Asp Lys Phe Asn Val Glu Ala Ile Lys Glu Asp Gly Ser
           1700                1705                1710

Met Leu Phe Ile Asp Thr Lys Pro Val Asn Leu Ser Met Asp Lys Asn
       1715                1720                1725

Tyr Phe Asn Pro Ser Lys Ser Asn Lys Ile Tyr Val Arg Asn Pro Glu
   1730                1735                1740

Phe Tyr Leu Arg Gly Lys Ile Ser Asp Lys Gly Gly Phe Asn Trp Glu
1745                1750                1755                1760

Leu Arg Val Asn Glu Ser Val Val Asp Asn Tyr Leu Ile Tyr Gly Asp
               1765                1770                1775

Leu His Ile Asp Asn Thr Arg Asp Phe Asn Ile Lys Leu Asn Val Lys
           1780                1785                1790

Asp Gly Asp Ile Met Asp Trp Gly Met Lys Asp Tyr Lys Ala Asn Gly
       1795                1800                1805

Phe Pro Asp Lys Val Thr Asp Met Asp Gly Asn Val Tyr Leu Gln Thr
   1810                1815                1820

Gly Tyr Ser Asp Leu Asn Ala Lys Ala Val Gly Val His Tyr Gln Phe
1825                1830                1835                1840

Leu Tyr Asp Asn Val Lys Pro Glu Val Asn Ile Asp Pro Lys Gly Asn
               1845                1850                1855

Thr Ser Ile Glu Tyr Ala Asp Gly Lys Ser Val Val Phe Asn Ile Asn
           1860                1865                1870

Asp Lys Arg Asn Asn Gly Phe Asp Gly Glu Ile Gln Glu Gln His Ile
       1875                1880                1885

Tyr Ile Asn Gly Lys Glu Tyr Thr Ser Phe Asn Asp Ile Lys Gln Ile
   1890                1895                1900

Ile Asp Lys Thr Leu Asn Ile Lys Ile Val Val Lys Asp Phe Ala Arg
1905                1910                1915                1920

Asn Thr Thr Val Lys Glu Phe Ile Leu Asn Lys Asp Thr Gly Glu Val
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1925 1930 1935

Ser Glu Leu Lys Pro His Arg Val Thr Val Thr Ile Gln Asn Gly Lys
1940 1945 1950

Glu Met Ser Ser Thr Ile Val Ser Glu Glu Asp Phe Ile Leu Pro Val
1955 1960 1965

Tyr Lys Gly Glu Leu Glu Lys Gly Tyr Gln Phe Asp Gly Trp Glu Ile
1970 1975 1980

Ser Gly Phe Glu Gly Lys Lys Asp Ala Gly Tyr Val Ile Asn Leu Ser
1985 1990 1995 2000

Lys Asp Thr Phe Ile Lys Pro Val Phe Lys Lys Ile Glu Glu Lys Lys
2005 2010 2015

Glu Glu Glu Asn Lys Pro Thr Phe Asp Val Ser Lys Lys Lys Asp Asn
2020 2025 2030

Pro Gln Val Asn His Ser Gln Leu Asn Glu Ser His Arg Lys Glu Asp
2035 2040 2045

Leu Gln Arg Glu Glu His Ser Gln Lys Ser Asp Ser Thr Lys Asp Val
2050 2055 2060

Thr Ala Thr Val Leu Asp Lys Asn Asn Ile Ser Ser Lys Ser Thr Thr
2065 2070 2075 2080

Asn Asn Pro Asn Lys Leu Pro Lys Thr Gly Thr Ala Ser Gly Ala Gln
2085 2090 2095

Thr Leu Leu Ala Ala Gly Ile Met Phe Ile Val Gly Ile Phe Leu Gly
2100 2105 2110

Leu Lys Lys Lys Asn Gln Asp
2115

<210> 29
<211> 597
<212> DNA
<213> Streptococcus pneumoniae

<400> 29
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aaagatgtgc gtacggctat cgaaattgca accttagcgc caagcgccca caacagccag 120
ccttggaaat ttgtggtggt acgtgagaaa aatgctgaac tggcaaagtt agcttatggt 180
tccaattttg aacaggtatc atcagcgcct gtaaccattg ccttgtttac agatacggac 240
ttagccaaac gtgctcgtaa gattgcccgt gttggtggtg ctaataactt ttctgaagag 300
caacttcaat attttatgaa aaatctgcca gctgagtttg cccgttacag tgagcaacaa 360
gtcagcgact acctagctct caatgcaggt ttggttgcca tgaacttggt tcttgcattg 420
acagaccaag gaattggttc taacattatt cttggttttg acaaatcaaa agttaatgaa 480
gttttggaaa tcgaagaccg tttccgccca gaactcttga tcacagtggg ttatacagac 540
gaaaaattgg aaccaagcta ccgcttgcca gtagatgaaa tcatcgagaa aagatag 597

<210> 30
<211> 198
<212> PRT
<213> Streptococcus pneumoniae

<400> 30
Leu Glu Leu Asn Lys Lys Arg His Ala Thr Lys His Phe Thr Asp Lys
1 5 10 15

Leu Val Asp Pro Lys Asp Val Arg Thr Ala Ile Glu Ile Ala Thr Leu
20 25 30

Ala Pro Ser Ala His Asn Ser Gln Pro Trp Lys Phe Val Val Val Arg
35 40 45

Glu Lys Asn Ala Glu Leu Ala Lys Leu Ala Tyr Gly Ser Asn Phe Glu
50 55 60

Gln Val Ser Ser Ala Pro Val Thr Ile Ala Leu Phe Thr Asp Thr Asp
65 70 75 80

Leu Ala Lys Arg Ala Arg Lys Ile Ala Arg Val Gly Gly Ala Asn Asn
85 90 95

Phe Ser Glu Glu Gln Leu Gln Tyr Phe Met Lys Asn Leu Pro Ala Glu
100 105 110

Phe Ala Arg Tyr Ser Glu Gln Gln Val Ser Asp Tyr Leu Ala Leu Asn
115 120 125

Ala Gly Leu Val Ala Met Asn Leu Val Leu Ala Leu Thr Asp Gln Gly
130 135 140

Ile Gly Ser Asn Ile Ile Leu Gly Phe Asp Lys Ser Lys Val Asn Glu
145 150 155 160

Val Leu Glu Ile Glu Asp Arg Phe Arg Pro Glu Leu Leu Ile Thr Val
165 170 175

Gly Tyr Thr Asp Glu Lys Leu Glu Pro Ser Tyr Arg Leu Pro Val Asp
180 185 190

Glu Ile Ile Glu Lys Arg
195

<210> 31
<211> 1401
<212> DNA
<213> Streptococcus pneumoniae

<400> 31
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ccatttgggc ctggtccagt aaaagccttg gagaaattcc ttgaaatcgc agaccgcgat 180

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gaagttctcg gaatctttgc ccatatggat gtggtgcctg ctggtagcgg ttgggacaca 300
gacccttaca caccaactat caaagatggt cgcctttatg cgcgcggggc ttcggacgat 360
aagggtccta caacagcttg ttactatggt ttgaaaatca tcaaagaatt gggtcttcca 420
acttctaaga aagttcgctt catcgttgga acagacgaag aatcaggctg ggcagacatg 480
gactactact ttgagcacgt aggacttgcc aaaccagatt tcggtttctc accagatgct 540
gaatttccaa tcatcaatgg tgaaaaagga aatatcacgg aatacctcca ctttgcagga 600
gaaaatacag gtgttgcccg tcttcacagc tttacaggtg gtttacgtga aaatatggta 660
ccagaatcag caacagcagt cgtttcaggt gacttggctg acttgcaagc taaactagat 720
gcctttgttg cagaacacaa acttagagga gaactccaag aagaagctgg caaatacaag 780
gtgacgatca ttggtaaatc agcccacggt gctatgcctg cttcaggtgt caatggcgca 840
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gacatcgcag gtaaaattct cttgaacgat catgagggtg aaaatcttaa gattgctcat 960
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gccaatgaat ttatcgcctt ggatgatctt ttccgagcag cagcaattta tgccgaagct 1380
atttacgaat tgatcaaata a                                          1401
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<210> 32
<211> 466
<212> PRT
<213> Streptococcus pneumoniae

<400> 32

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Met Thr Ala Ile Asp Phe Thr Ala Glu Val Glu Lys Arg Lys Glu Asp
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Leu Leu Ala Asp Leu Phe Ser Leu Leu Glu Ile Asn Ser Glu Arg Asp
             20                  25                  30

Asp Ser Lys Ala Asp Ala Gln His Pro Phe Gly Pro Gly Pro Val Lys
         35                  40                  45

Ala Leu Glu Lys Phe Leu Glu Ile Ala Asp Arg Asp Gly Tyr Pro Thr
     50                  55                  60

Lys Asn Val Asp Asn Tyr Ala Gly His Phe Glu Phe Gly Asp Gly Glu
 65                  70                  75                  80

Glu Val Leu Gly Ile Phe Ala His Met Asp Val Val Pro Ala Gly Ser
                 85                  90                  95

Gly Trp Asp Thr Asp Pro Tyr Thr Pro Thr Ile Lys Asp Gly Arg Leu
            100                 105                 110

Tyr Ala Arg Gly Ala Ser Asp Asp Lys Gly Pro Thr Thr Ala Cys Tyr
        115                 120                 125

Tyr Gly Leu Lys Ile Ile Lys Glu Leu Gly Leu Pro Thr Ser Lys Lys
    130                 135                 140

Val Arg Phe Ile Val Gly Thr Asp Glu Glu Ser Gly Trp Ala Asp Met
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145                 150                 155                 160

Asp Tyr Tyr Phe Glu His Val Gly Leu Ala Lys Pro Asp Phe Gly Phe
                165                 170                 175

Ser Pro Asp Ala Glu Phe Pro Ile Ile Asn Gly Glu Lys Gly Asn Ile
            180                 185                 190

Thr Glu Tyr Leu His Phe Ala Gly Glu Asn Thr Gly Val Ala Arg Leu
        195                 200                 205

His Ser Phe Thr Gly Gly Leu Arg Glu Asn Met Val Pro Glu Ser Ala
    210                 215                 220

Thr Ala Val Val Ser Gly Asp Leu Ala Asp Leu Gln Ala Lys Leu Asp
225                 230                 235                 240

Ala Phe Val Ala Glu His Lys Leu Arg Gly Glu Leu Gln Glu Glu Ala
                245                 250                 255

Gly Lys Tyr Lys Val Thr Ile Ile Gly Lys Ser Ala His Gly Ala Met
            260                 265                 270

Pro Ala Ser Gly Val Asn Gly Ala Thr Tyr Leu Ala Leu Phe Leu Ser
        275                 280                 285

Gln Phe Gly Phe Ala Gly Pro Ala Lys Asp Tyr Leu Asp Ile Ala Gly
    290                 295                 300

Lys Ile Leu Leu Asn Asp His Glu Gly Glu Asn Leu Lys Ile Ala His
305                 310                 315                 320

Val Asp Glu Lys Met Gly Ala Leu Ser Met Asn Ala Gly Val Phe His
                325                 330                 335

Phe Asp Glu Thr Ser Ala Asp Asn Thr Ile Ala Leu Asn Ile Arg Tyr
            340                 345                 350

Pro Lys Gly Thr Ser Pro Glu Gln Ile Lys Ser Ile Leu Glu Asn Leu
        355                 360                 365

Pro Val Val Ser Val Ser Leu Ser Glu His Gly His Thr Pro His Tyr
    370                 375                 380

Val Pro Met Glu Asp Pro Leu Val Gln Thr Leu Leu Asn Ile Tyr Glu
385                 390                 395                 400

Lys Gln Thr Gly Phe Lys Gly His Glu Gln Val Ile Gly Gly Gly Thr
                405                 410                 415

Phe Gly Arg Leu Leu Glu Arg Gly Val Ala Tyr Gly Ala Met Phe Pro
            420                 425                 430

Asp Ser Ile Asp Thr Met His Gln Ala Asn Glu Phe Ile Ala Leu Asp
        435                 440                 445

Asp Leu Phe Arg Ala Ala Ala Ile Tyr Ala Glu Ala Ile Tyr Glu Leu
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    450                 455                 460

Ile Lys
465
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<210> 33
<211> 1617
<212> DNA
<213> Streptococcus pneumoniae

<400> 33

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attgcgatga atttagagcg gtttttgaaa ttgtcaatct accaaatgat tgtctggtgt 180
gggataatat tccttgactg ggtagtgaaa aattatcagg ttgaagtgat ccaagagttt 240
aatctagaga ttcgaaatag agttgccaca gacatctcta actctaccta tcaagaattt 300
catagtaaat catcaggaac atatctttcg tggctaaata atgatgttca gactttaaat 360
gatcaggcgt ttaaacaact ttttttagta ataaaaggaa tttctggtac tatatttgca 420
gttgtgactc ttaatcacta tcattggtca ttgactgtag ccaccttgtt ttcattaatg 480
attatgctac ttgtaccaaa aatctttgca tcgaaaatgc gagaagttag tctaaattta 540
actaaccaaa atgaagcttt tttaaaatct agtgagacta tattgaatgg atttgatgtg 600
ttagcgtcct tgaatctttt atatgtattg cctaagaaaa ttaaagaagc aggaatttta 660
ttaaagatgg ttatacaaag aaagacaact gtagaaacgt tagcaggcgc tattagcttc 720
tttctcaata tttttttttca gatatctctc gtttttttaa caggctatct tgcaataaaa 780
ggaatagtga aaattggtac tattgaagca ataggagcac taacaggtgt tatttttaca 840
gcgctaggtg aattaggagg tcaattatcc tctattattg gtacgaagcc tatttttta 900
aaattgtatt caattaatcc aattgagtca aataaaatga atgatatcga accaaatgag 960
gtgaatagag attttccgtt atatgaagca aaaaatattt gctataagta tggagataaa 1020
gaaatattaa aaaacttaaa tttttgtttt caacgtaatg aaaagtattt aattttaggt 1080
gaaagtggaa gcgggaaatc tacattatta aaattattga atggcttttt gagagattat 1140
agtggagaat tgcgattctg cggggatgat ataaaaaaaa cctcctattt aaatatggtt 1200
tcgaatgttc tatatgtaga tcaaaaagct tatttgtttg aaggtacgat tagagataat 1260
attttattgg aagaaaatta tactgatgaa gaaatactac agtctttaga gcaagttggt 1320
ttgagtgtaa aagattttcc taataacatt ttagattatt atgttggtga tgatgggaga 1380
ttactgtcag gagggcagaa acaaaaaatt actttagcta gagggctaat tagaaataag 1440
aaaatagtat taattgacga gggaacttct gctatcgata ggagaacttc gttagcgatt 1500
gaacgtaaga tattagatag agaggatttg actgtcatta ttgttaccca tgctccgcat 1560
ccggaactta aacaatattt tactaagata tatcaatttc caaaggattt tatttaa    1617
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<210> 34
<211> 538
<212> PRT
<213> Streptococcus pneumoniae

<400> 34

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Met Tyr Thr Ile Ile Lys Ser Asn Ile Lys Lys Phe Ser Leu Leu Thr
  1               5                  10                  15

Ile Phe Ile Val Ala Gly Gln Leu Leu Leu Ile Tyr Ala Ala Thr Ile
             20                  25                  30

Asn Ala Leu Val Leu Asn Glu Leu Ile Ala Met Asn Leu Glu Arg Phe
         35                  40                  45
```

```
Leu Lys Leu Ser Ile Tyr Gln Met Ile Val Trp Cys Gly Ile Ile Phe
     50                  55                  60

Leu Asp Trp Val Val Lys Asn Tyr Gln Val Glu Val Ile Gln Glu Phe
 65                  70                  75                  80

Asn Leu Glu Ile Arg Asn Arg Val Ala Thr Asp Ile Ser Asn Ser Thr
                85                  90                  95

Tyr Gln Glu Phe His Ser Lys Ser Ser Gly Thr Tyr Leu Ser Trp Leu
            100                 105                 110

Asn Asn Asp Val Gln Thr Leu Asn Asp Gln Ala Phe Lys Gln Leu Phe
        115                 120                 125

Leu Val Ile Lys Gly Ile Ser Gly Thr Ile Phe Ala Val Val Thr Leu
    130                 135                 140

Asn His Tyr His Trp Ser Leu Thr Val Ala Thr Leu Phe Ser Leu Met
145                 150                 155                 160

Ile Met Leu Leu Val Pro Lys Ile Phe Ala Ser Lys Met Arg Glu Val
                165                 170                 175

Ser Leu Asn Leu Thr Asn Gln Asn Glu Ala Phe Leu Lys Ser Ser Glu
            180                 185                 190

Thr Ile Leu Asn Gly Phe Asp Val Leu Ala Ser Leu Asn Leu Leu Tyr
        195                 200                 205

Val Leu Pro Lys Lys Ile Lys Glu Ala Gly Ile Leu Leu Lys Met Val
    210                 215                 220

Ile Gln Arg Lys Thr Thr Val Glu Thr Leu Ala Gly Ala Ile Ser Phe
225                 230                 235                 240

Phe Leu Asn Ile Phe Phe Gln Ile Ser Leu Val Phe Leu Thr Gly Tyr
                245                 250                 255

Leu Ala Ile Lys Gly Ile Val Lys Ile Gly Thr Ile Glu Ala Ile Gly
            260                 265                 270

Ala Leu Thr Gly Val Ile Phe Thr Ala Leu Gly Glu Leu Gly Gly Gln
        275                 280                 285

Leu Ser Ser Ile Ile Gly Thr Lys Pro Ile Phe Leu Lys Leu Tyr Ser
    290                 295                 300

Ile Asn Pro Ile Glu Ser Asn Lys Met Asn Asp Ile Glu Pro Asn Glu
305                 310                 315                 320

Val Asn Arg Asp Phe Pro Leu Tyr Glu Ala Lys Asn Ile Cys Tyr Lys
                325                 330                 335

Tyr Gly Asp Lys Glu Ile Leu Lys Asn Leu Asn Phe Cys Phe Gln Arg
            340                 345                 350
```

```
Asn Glu Lys Tyr Leu Ile Leu Gly Glu Ser Gly Ser Gly Lys Ser Thr
        355                 360                 365

Leu Leu Lys Leu Leu Asn Gly Phe Leu Arg Asp Tyr Ser Gly Glu Leu
    370                 375                 380

Arg Phe Cys Gly Asp Asp Ile Lys Lys Thr Ser Tyr Leu Asn Met Val
385                 390                 395                 400

Ser Asn Val Leu Tyr Val Asp Gln Lys Ala Tyr Leu Phe Glu Gly Thr
                405                 410                 415

Ile Arg Asp Asn Ile Leu Leu Glu Glu Asn Tyr Thr Asp Glu Glu Ile
            420                 425                 430

Leu Gln Ser Leu Glu Gln Val Gly Leu Ser Val Lys Asp Phe Pro Asn
        435                 440                 445

Asn Ile Leu Asp Tyr Tyr Val Gly Asp Asp Gly Arg Leu Leu Ser Gly
    450                 455                 460

Gly Gln Lys Gln Lys Ile Thr Leu Ala Arg Gly Leu Ile Arg Asn Lys
465                 470                 475                 480

Lys Ile Val Leu Ile Asp Glu Gly Thr Ser Ala Ile Asp Arg Arg Thr
                485                 490                 495

Ser Leu Ala Ile Glu Arg Lys Ile Leu Asp Arg Glu Asp Leu Thr Val
            500                 505                 510

Ile Ile Val Thr His Ala Pro His Pro Glu Leu Lys Gln Tyr Phe Thr
        515                 520                 525

Lys Ile Tyr Gln Phe Pro Lys Asp Phe Ile
    530                 535
```

<210> 35
<211> 705
<212> DNA
<213> Streptococcus pneumoniae

<400> 35
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ataacagtta aacagattat ggacgaaata gccgtttcag atatgactgc aaggcgctat 60
ttacaggaat tagctgataa agatttgctg attcgtgtgc atggtggagc tgaaaaactt 120
cgaaccaact ccctttgac taatgagcga tcaaatattg aaaaacaagc cctccaaacg 180
gcagaaaaac aagaaatagc ccattttgca ggcagtctag tagaagaaag agaaactatt 240
ttcattggac caggaacaac attagagttt tttgcgcgtg agttgcctat tgacaatatc 300
cgcgtcgtaa ccaacagtct acctgttttt ctgattttaa gcgaacgaaa attaacagat 360
ttgattttaa taggtggaaa ttatcgcgat attacaggtg cttttgttgg tacattgacc 420
ctacaaaatc tctctaatct ccaatttttct aaagctttcg ttagctgtaa tggtattcaa 480
aacggagctc tagctacttt tagcgaggaa gagggagagg ctcaacgcat cgctttaaat 540
aattctaata aaaaatattt actcgcagat catagcaagt tcaataagtt tgatttttat 600
acttttttata atgtatcaaa tcttgatact attgtttcag attctaaact aagtgattca 660
atccttttta agctatctaa acacattaaa gtcatcaagc cttaa                 705
```

<210> 36
<211> 234
<212> PRT
<213> Streptococcus pneumoniae

<400> 36
Ile Thr Val Lys Gln Ile Met Asp Glu Ile Ala Val Ser Asp Met Thr
1 5 10 15

Ala Arg Arg Tyr Leu Gln Glu Leu Ala Asp Lys Asp Leu Leu Ile Arg
20 25 30

Val His Gly Gly Ala Glu Lys Leu Arg Thr Asn Ser Leu Leu Thr Asn
35 40 45

Glu Arg Ser Asn Ile Glu Lys Gln Ala Leu Gln Thr Ala Glu Lys Gln
50 55 60

Glu Ile Ala His Phe Ala Gly Ser Leu Val Glu Glu Arg Glu Thr Ile
65 70 75 80

Phe Ile Gly Pro Gly Thr Thr Leu Glu Phe Phe Ala Arg Glu Leu Pro
85 90 95

Ile Asp Asn Ile Arg Val Val Thr Asn Ser Leu Pro Val Phe Leu Ile
100 105 110

Leu Ser Glu Arg Lys Leu Thr Asp Leu Ile Leu Ile Gly Gly Asn Tyr
115 120 125

Arg Asp Ile Thr Gly Ala Phe Val Gly Thr Leu Thr Leu Gln Asn Leu
130 135 140

Ser Asn Leu Gln Phe Ser Lys Ala Phe Val Ser Cys Asn Gly Ile Gln
145 150 155 160

Asn Gly Ala Leu Ala Thr Phe Ser Glu Glu Glu Gly Glu Ala Gln Arg
165 170 175

Ile Ala Leu Asn Asn Ser Asn Lys Lys Tyr Leu Leu Ala Asp His Ser
180 185 190

Lys Phe Asn Lys Phe Asp Phe Tyr Thr Phe Tyr Asn Val Ser Asn Leu
195 200 205

Asp Thr Ile Val Ser Asp Ser Lys Leu Ser Asp Ser Ile Leu Phe Lys
210 215 220

Leu Ser Lys His Ile Lys Val Ile Lys Pro
225 230

<210> 37
<211> 483
<212> DNA

<213> Streptococcus pneumoniae

<400> 37
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tactatcact tgaaacagct agacaaaaca gataaagacc aagagcttaa aactgaaatt 120
caatccatct ttatcgaaca caagggaaat tatgcttatc gccgggttca tttagaacta 180
agaaatcgtg gttatctggt aaatcataaa agagttcaag gcttgatgaa agtactcaat 240
ttacaagcta aaatgcgaaa gaaacgaaaa tattcttctc ataaaggaga cgttggtaag 300
aaggcagaga atctcattca agcccaattt gaaggctcta aaacaatgga aaagtgctac 360
acagatgtga ctgaatttgc cattccagca agtactcaaa agctttactt atcaccagtt 420
ttagatggct ttaacagcga aattattgct tttaatcttt cttgttcgcc taatttagaa 480
taa 483

<210> 38
<211> 160
<212> PRT
<213> Streptococcus pneumoniae

<400> 38
Met Thr Glu Phe Ser Leu Asp Leu Leu Leu Glu Ala Ile Lys Leu Ala
1 5 10 15

Arg Trp Thr Tyr Tyr Tyr His Leu Lys Gln Leu Asp Lys Thr Asp Lys
20 25 30

Asp Gln Glu Leu Lys Thr Glu Ile Gln Ser Ile Phe Ile Glu His Lys
35 40 45

Gly Asn Tyr Ala Tyr Arg Arg Val His Leu Glu Leu Arg Asn Arg Gly
50 55 60

Tyr Leu Val Asn His Lys Arg Val Gln Gly Leu Met Lys Val Leu Asn
65 70 75 80

Leu Gln Ala Lys Met Arg Lys Lys Arg Lys Tyr Ser Ser His Lys Gly
85 90 95

Asp Val Gly Lys Lys Ala Glu Asn Leu Ile Gln Ala Gln Phe Glu Gly
100 105 110

Ser Lys Thr Met Glu Lys Cys Tyr Thr Asp Val Thr Glu Phe Ala Ile
115 120 125

Pro Ala Ser Thr Gln Lys Leu Tyr Leu Ser Pro Val Leu Asp Gly Phe
130 135 140

Asn Ser Glu Ile Ile Ala Phe Asn Leu Ser Cys Ser Pro Asn Leu Glu
145 150 155 160

<210> 39
<211> 1266

<212> DNA
<213> Streptococcus pneumoniae

<400> 39
ccaggatttg gtaccgttgc aagtggtgtg cctttcctcc taaaggaaaa tggaggaaaa 60
atcaatcaat cagcacattc agatatcaaa gttgctaagg tattggtcaa ggatgaagat 120
gaaaaaaatc gcttgcttgc agcagggaat gactttaact ttgtaaccaa tgtggatgat 180
attttatcag accaggatat tactatcgta gtggaattga tggggcgtat tgagcctgct 240
aaaaccttta tcactcgtgc cttggaagct ggaaaacacg ttgttactgc taacaaggac 300
cttttagctg tccatggcgc agaattgcta gaaatcgctc aagctaacaa ggtagcactt 360
tactacgaag cagcagttgc tggtgggatt ccaattcttc gtactttagc aaattccttg 420
gcttctgata aaattacgcg cgtgcttgga gtagtcaacg gaacttccaa cttcatggtg 480
accaagatgg tggaagaagg ctggtcttac gatgatgctc ttgcggaagc acaacgtcta 540
ggatttgcag aaagcgatcc gacgaatgac gtagatggga ttgatgcagc ctacaagatg 600
gttattttga gccaatttgc ctttggcatg aagattgcct ttgatgatgt agcccacaag 660
ggaatccgca atatcacacc agaagacgta gctgtagctc aagagcttgg ttacgtagtg 720
aaattggttg gttctattga ggaaacttct tcaggtattg ctgcagaagt gactccaacc 780
ttcctaccta aagcgcaccc acttgctagt gtgaatggcg taatgaacgc tgtctttgta 840
gaatctatcg gtattggtga gtctatgtac tacggaccag gtgcgggtca aaaaccaact 900
gcaacaagtg ttgtagctga tattgtccgt atcgttcgtc gtttgaatga tggtactatt 960
ggcaaagact tcaacgaata tagccgtgac ttggtcttgg caaatcctga agatgtcaaa 1020
gcaaactact atttctcaat cttggctcta gactcaaaag gtcaggtctt gaagttggct 1080
gaaatcttca atgctcaaga tatttccttt aagcaaatcc ttcaagatgg caaagagggt 1140
gacaaggcgc gtgtcgttat catcacacac aagattaata aagcccagct tgaaaatgtc 1200
tcagctgaat tgaagaaggt ttcagaattc gacctcttga ataccttcaa ggtgctagga 1260
gaataa 1266

<210> 40
<211> 421
<212> PRT
<213> Streptococcus pneumoniae

<400> 40
Pro Gly Phe Gly Thr Val Ala Ser Gly Val Pro Phe Leu Leu Lys Glu
1 5 10 15

Asn Gly Gly Lys Ile Asn Gln Ser Ala His Ser Asp Ile Lys Val Ala
20 25 30

Lys Val Leu Val Lys Asp Glu Asp Glu Lys Asn Arg Leu Leu Ala Ala
35 40 45

Gly Asn Asp Phe Asn Phe Val Thr Asn Val Asp Asp Ile Leu Ser Asp
50 55 60

Gln Asp Ile Thr Ile Val Val Glu Leu Met Gly Arg Ile Glu Pro Ala
65 70 75 80

Lys Thr Phe Ile Thr Arg Ala Leu Glu Ala Gly Lys His Val Val Thr
85 90 95

Ala Asn Lys Asp Leu Leu Ala Val His Gly Ala Glu Leu Leu Glu Ile
100 105 110

Ala Gln Ala Asn Lys Val Ala Leu Tyr Tyr Glu Ala Ala Val Ala Gly
115 120 125

```
Gly Ile Pro Ile Leu Arg Thr Leu Ala Asn Ser Leu Ala Ser Asp Lys
    130                 135                 140

Ile Thr Arg Val Leu Gly Val Val Asn Gly Thr Ser Asn Phe Met Val
145                 150                 155                 160

Thr Lys Met Val Glu Glu Gly Trp Ser Tyr Asp Asp Ala Leu Ala Glu
                165                 170                 175

Ala Gln Arg Leu Gly Phe Ala Glu Ser Asp Pro Thr Asn Asp Val Asp
            180                 185                 190

Gly Ile Asp Ala Ala Tyr Lys Met Val Ile Leu Ser Gln Phe Ala Phe
        195                 200                 205

Gly Met Lys Ile Ala Phe Asp Asp Val Ala His Lys Gly Ile Arg Asn
    210                 215                 220

Ile Thr Pro Glu Asp Val Ala Val Ala Gln Glu Leu Gly Tyr Val Val
225                 230                 235                 240

Lys Leu Val Gly Ser Ile Glu Glu Thr Ser Ser Gly Ile Ala Ala Glu
                245                 250                 255

Val Thr Pro Thr Phe Leu Pro Lys Ala His Pro Leu Ala Ser Val Asn
            260                 265                 270

Gly Val Met Asn Ala Val Phe Val Glu Ser Ile Gly Ile Gly Glu Ser
        275                 280                 285

Met Tyr Tyr Gly Pro Gly Ala Gly Gln Lys Pro Thr Ala Thr Ser Val
    290                 295                 300

Val Ala Asp Ile Val Arg Ile Val Arg Arg Leu Asn Asp Gly Thr Ile
305                 310                 315                 320

Gly Lys Asp Phe Asn Glu Tyr Ser Arg Asp Leu Val Leu Ala Asn Pro
                325                 330                 335

Glu Asp Val Lys Ala Asn Tyr Tyr Phe Ser Ile Leu Ala Leu Asp Ser
            340                 345                 350

Lys Gly Gln Val Leu Lys Leu Ala Glu Ile Phe Asn Ala Gln Asp Ile
        355                 360                 365

Ser Phe Lys Gln Ile Leu Gln Asp Gly Lys Glu Gly Asp Lys Ala Arg
    370                 375                 380

Val Val Ile Ile Thr His Lys Ile Asn Lys Ala Gln Leu Glu Asn Val
385                 390                 395                 400

Ser Ala Glu Leu Lys Lys Val Ser Glu Phe Asp Leu Leu Asn Thr Phe
                405                 410                 415

Lys Val Leu Gly Glu
            420
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<210> 41
<211> 1725
<212> DNA
<213> Streptococcus pneumoniae

<400> 41
atgaaacacc tattatctta cttcaaaccc tacatcaagg aatcaatttt agccccccttg 60
ttcaagctgt tagaagctgt ttttgagctc ttggttccca tggtgattgc tgggattgtt 120
gaccaatctt tacctcaggg agatcaaggt catctctgga tgcagattgg cctgctcctt 180
atctttgcag taattggcgt tttagtggcc ttgatagctc aattttactc agcaaaggca 240
gcagtaggtt ctgctaagga attgacaaac gatctttatc gtcatattct ttccttgccc 300
aaggacagca gagaccgtct gacaacttct agtttggtca ctcgcttgac ttcggatacc 360
taccagattc agactggtat caatcaattc ctgcgtctct ttttacgagc gcccattatc 420
gtttttggtg ccatttttat ggcttatcga atctcagctg agttgacttt ctggttctta 480
gtcttggttg ccattttgac cattgtcatt gtagggttat ctcgattggt caatcctttc 540
tacagtagtc tcagaaagaa aacggaccaa ctggttcagg aaacgcgcca gcaattgcaa 600
gggatgcggg ttattcgtgc ttttggtcaa gaaaaacgag agttacagat ttttcaaacc 660
cttaaccaag tttatgctag attacaagaa aagacaggtt tctggtctag tttattaaca 720
cctctgacct atctgattgt caatggaact cttctcgtta ttatctggca aggctatatt 780
tcaattcaag gaggagtgct cagtcaaggt gctctcattg ctcttatcaa ttacctctta 840
cagattttgg tggaattggt caagctagcc atgttgatca attccctcaa ccagtcctat 900
atctcagtca agcgaatcga ggaagtcttt gttgaggctc cagaggatat ccattcagag 960
ttagaacaaa agcaagctac cagagataag gttttacaag tccaagaatt gacctttacc 1020
tatcctgatg cggcccagcc ttctctgaga tacatttcct ttgatatgac tcaaggacaa 1080
attctaggta tcatcggggg aactggttct ggtaaatcaa gcttggtgca actcttactt 1140
ggactttatc cagtagacaa ggggaacatt gacctttatc aaaatggacg tagtcctctt 1200
aatttggagc agtggcggtc ttggattgcc tatgtacctc aaaaggtcga actctttaaa 1260
ggaaccattc gttccaactt gactctaggt ttcaatcaag aagtatctga ccaggaactc 1320
tggcaggcct tggagattgc gcaagctaag gattttgtca gtgaaaagga aggactcttg 1380
gatgctctag ttgaggcagg ggggcgaaat ttctcaggtg gacaaaaaca aagattgtct 1440
atcgcccgag cagtcttgcg ccaggctccg tttctcatcc tagatgatgc aacctcggca 1500
ctggatacca ttacagagtc caagctcttg aaagctatta gagaaaattt tccaaacacg 1560
agcttaattt tgatctctca acgaacctca actttacaga tggcggacca gattctcctc 1620
ttggaaaaag gtgagttgct agctgttggc aagcacgatg acttgatgaa atccagccaa 1680
gtctattgtg aaatcaatgc atcccaacat ggaaaggagg actag 1725

<210> 42
<211> 574
<212> PRT
<213> Streptococcus pneumoniae

<400> 42
Met Lys His Leu Leu Ser Tyr Phe Lys Pro Tyr Ile Lys Glu Ser Ile
1 5 10 15

Leu Ala Pro Leu Phe Lys Leu Leu Glu Ala Val Phe Glu Leu Leu Val
20 25 30

Pro Met Val Ile Ala Gly Ile Val Asp Gln Ser Leu Pro Gln Gly Asp
35 40 45

Gln Gly His Leu Trp Met Gln Ile Gly Leu Leu Leu Ile Phe Ala Val
50 55 60

```
Ile Gly Val Leu Val Ala Leu Ile Ala Gln Phe Tyr Ser Ala Lys Ala
 65                  70                  75                  80

Ala Val Gly Ser Ala Lys Glu Leu Thr Asn Asp Leu Tyr Arg His Ile
                 85                  90                  95

Leu Ser Leu Pro Lys Asp Ser Arg Asp Arg Leu Thr Thr Ser Ser Leu
            100                 105                 110

Val Thr Arg Leu Thr Ser Asp Thr Tyr Gln Ile Gln Thr Gly Ile Asn
        115                 120                 125

Gln Phe Leu Arg Leu Phe Leu Arg Ala Pro Ile Ile Val Phe Gly Ala
    130                 135                 140

Ile Phe Met Ala Tyr Arg Ile Ser Ala Glu Leu Thr Phe Trp Phe Leu
145                 150                 155                 160

Val Leu Val Ala Ile Leu Thr Ile Val Ile Val Gly Leu Ser Arg Leu
                165                 170                 175

Val Asn Pro Phe Tyr Ser Ser Leu Arg Lys Lys Thr Asp Gln Leu Val
            180                 185                 190

Gln Glu Thr Arg Gln Gln Leu Gln Gly Met Arg Val Ile Arg Ala Phe
        195                 200                 205

Gly Gln Glu Lys Arg Glu Leu Gln Ile Phe Gln Thr Leu Asn Gln Val
    210                 215                 220

Tyr Ala Arg Leu Gln Glu Lys Thr Gly Phe Trp Ser Ser Leu Leu Thr
225                 230                 235                 240

Pro Leu Thr Tyr Leu Ile Val Asn Gly Thr Leu Leu Val Ile Ile Trp
                245                 250                 255

Gln Gly Tyr Ile Ser Ile Gln Gly Gly Val Leu Ser Gln Gly Ala Leu
            260                 265                 270

Ile Ala Leu Ile Asn Tyr Leu Leu Gln Ile Leu Val Glu Leu Val Lys
        275                 280                 285

Leu Ala Met Leu Ile Asn Ser Leu Asn Gln Ser Tyr Ile Ser Val Lys
    290                 295                 300

Arg Ile Glu Glu Val Phe Val Glu Ala Pro Glu Asp Ile His Ser Glu
305                 310                 315                 320

Leu Glu Gln Lys Gln Ala Thr Arg Asp Lys Val Leu Gln Val Gln Glu
                325                 330                 335

Leu Thr Phe Thr Tyr Pro Asp Ala Ala Gln Pro Ser Leu Arg Tyr Ile
            340                 345                 350

Ser Phe Asp Met Thr Gln Gly Gln Ile Leu Gly Ile Ile Gly Gly Thr
        355                 360                 365
```

```
Gly Ser Gly Lys Ser Ser Leu Val Gln Leu Leu Leu Gly Leu Tyr Pro
    370                 375                 380

Val Asp Lys Gly Asn Ile Asp Leu Tyr Gln Asn Gly Arg Ser Pro Leu
385                 390                 395                 400

Asn Leu Glu Gln Trp Arg Ser Trp Ile Ala Tyr Val Pro Gln Lys Val
                405                 410                 415

Glu Leu Phe Lys Gly Thr Ile Arg Ser Asn Leu Thr Leu Gly Phe Asn
            420                 425                 430

Gln Glu Val Ser Asp Gln Glu Leu Trp Gln Ala Leu Glu Ile Ala Gln
        435                 440                 445

Ala Lys Asp Phe Val Ser Glu Lys Glu Gly Leu Leu Asp Ala Leu Val
    450                 455                 460

Glu Ala Gly Gly Arg Asn Phe Ser Gly Gly Gln Lys Gln Arg Leu Ser
465                 470                 475                 480

Ile Ala Arg Ala Val Leu Arg Gln Ala Pro Phe Leu Ile Leu Asp Asp
                485                 490                 495

Ala Thr Ser Ala Leu Asp Thr Ile Thr Glu Ser Lys Leu Leu Lys Ala
            500                 505                 510

Ile Arg Glu Asn Phe Pro Asn Thr Ser Leu Ile Leu Ile Ser Gln Arg
        515                 520                 525

Thr Ser Thr Leu Gln Met Ala Asp Gln Ile Leu Leu Leu Glu Lys Gly
    530                 535                 540

Glu Leu Leu Ala Val Gly Lys His Asp Asp Leu Met Lys Ser Ser Gln
545                 550                 555                 560

Val Tyr Cys Glu Ile Asn Ala Ser Gln His Gly Lys Glu Asp
                565                 570
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<210> 43
<211> 1224
<212> DNA
<213> Streptococcus pneumoniae

<400> 43
atgaaacgtt ctctcgactc aagagtcgat tacagtttgc tcttgccagt atttttctta 60
ctggtcatcg gtgtggtggc tatctatata gccgttagtc atgattatcc caataatatt 120
ctgcccattt tagggcagca ggtcgcctgg attgccttgg ggcttgtgat tggttttgtg 180
gtcatgctct ttaatacaga atttctttgg aaggtgaccc cctttctata tatttaggc 240
ttgggactta tgatcttgcc gattgtattt tataatccaa gcttagttgc atcaacgggt 300
gccaaaaact gggtatcaat aaatggaatt accctattcc aaccgtcaga atttatgaag 360
atatcctata tcctcatgtt ggctcgtgtc attgtccaat ttacaaagaa acataaggaa 420
tggagacgca cggttccgct ggacttttg ttaattttct ggatgattct ctttaccatt 480
ccagtcctag ttcttttagc acttcaaagt gacttgggga cggctttggt ttttgtagcc 540

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attttctcag gaatcgtttt attatcaggg gtttcttgga aaattattat cccagtattt 600
gtgactgctg taacaggagt tgctggtttc ttagctatct ttattagcaa ggacggacga 660
gcttttcttc accagattgg aatgccgacc taccaaatta atcggatttt ggcttggctc 720
aatccctttg agtttgccca aacaacgact taccagcagg ctcaagggca gattgccatt 780
gggagtggtg gcttatttgg tcagggattt aatgcttcga atctgcttat cccagttcga 840
gagtcagata tgatttttac ggttattgca gaagattttg gctttattgg ctctgtcctg 900
gttattgccc tctatctcat gttgatttac cgtatgttga agattactct taaatcaaat 960
aaccagttct acacttatat ttccacaggt ttgattatga tgttgctctt ccacatcttt 1020
gagaatatcg gtgctgtgac tggactactt cctttgacgg ggattccctt gcctttcatt 1080
tcgcaagggg gatcagctat tatcagtaat ctgattggtg ttggtttgct tttatcgatg 1140
agttaccaga ctaatctagc tgaagaaaag agcggaaaag tcccattcaa acggaaaaag 1200
gttgtattaa aacaaattaa ataa                                       1224
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<210> 44
<211> 407
<212> PRT
<213> Streptococcus pneumoniae

<400> 44

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Met Lys Arg Ser Leu Asp Ser Arg Val Asp Tyr Ser Leu Leu Leu Pro
  1               5                  10                  15

Val Phe Phe Leu Leu Val Ile Gly Val Val Ala Ile Tyr Ile Ala Val
             20                  25                  30

Ser His Asp Tyr Pro Asn Asn Ile Leu Pro Ile Leu Gly Gln Gln Val
         35                  40                  45

Ala Trp Ile Ala Leu Gly Leu Val Ile Gly Phe Val Val Met Leu Phe
     50                  55                  60

Asn Thr Glu Phe Leu Trp Lys Val Thr Pro Phe Leu Tyr Ile Leu Gly
 65                  70                  75                  80

Leu Gly Leu Met Ile Leu Pro Ile Val Phe Tyr Asn Pro Ser Leu Val
                 85                  90                  95

Ala Ser Thr Gly Ala Lys Asn Trp Val Ser Ile Asn Gly Ile Thr Leu
            100                 105                 110

Phe Gln Pro Ser Glu Phe Met Lys Ile Ser Tyr Ile Leu Met Leu Ala
        115                 120                 125

Arg Val Ile Val Gln Phe Thr Lys Lys His Lys Glu Trp Arg Arg Thr
    130                 135                 140

Val Pro Leu Asp Phe Leu Leu Ile Phe Trp Met Ile Leu Phe Thr Ile
145                 150                 155                 160

Pro Val Leu Val Leu Leu Ala Leu Gln Ser Asp Leu Gly Thr Ala Leu
                165                 170                 175

Val Phe Val Ala Ile Phe Ser Gly Ile Val Leu Leu Ser Gly Val Ser
            180                 185                 190

Trp Lys Ile Ile Ile Pro Val Phe Val Thr Ala Val Thr Gly Val Ala
```

```
        195                 200                 205

Gly Phe Leu Ala Ile Phe Ile Ser Lys Asp Gly Arg Ala Phe Leu His
    210                 215                 220

Gln Ile Gly Met Pro Thr Tyr Gln Ile Asn Arg Ile Leu Ala Trp Leu
225                 230                 235                 240

Asn Pro Phe Glu Phe Ala Gln Thr Thr Thr Tyr Gln Gln Ala Gln Gly
                245                 250                 255

Gln Ile Ala Ile Gly Ser Gly Gly Leu Phe Gly Gln Gly Phe Asn Ala
            260                 265                 270

Ser Asn Leu Leu Ile Pro Val Arg Glu Ser Asp Met Ile Phe Thr Val
        275                 280                 285

Ile Ala Glu Asp Phe Gly Phe Ile Gly Ser Val Leu Val Ile Ala Leu
    290                 295                 300

Tyr Leu Met Leu Ile Tyr Arg Met Leu Lys Ile Thr Leu Lys Ser Asn
305                 310                 315                 320

Asn Gln Phe Tyr Thr Tyr Ile Ser Thr Gly Leu Ile Met Met Leu Leu
                325                 330                 335

Phe His Ile Phe Glu Asn Ile Gly Ala Val Thr Gly Leu Leu Pro Leu
            340                 345                 350

Thr Gly Ile Pro Leu Pro Phe Ile Ser Gln Gly Gly Ser Ala Ile Ile
        355                 360                 365

Ser Asn Leu Ile Gly Val Gly Leu Leu Leu Ser Met Ser Tyr Gln Thr
    370                 375                 380

Asn Leu Ala Glu Glu Lys Ser Gly Lys Val Pro Phe Lys Arg Lys Lys
385                 390                 395                 400

Val Val Leu Lys Gln Ile Lys
                405
```

<210> 45
<211> 1104
<212> DNA
<213> Streptococcus pneumoniae

<400> 45
atggtggcta agaaaaaaat cttatttttt atgtggtctt tttctcttgg aggtggtgca 60
gagaagattc tatcaaccat tgtttcaaat ctggatccag aaaagtatga tattgatatt 120
cttgaaatgg agcactttga caagggatat gaatctgttc caaagcatgt acgcatttta 180
aaatcccttc aagattatcg ccaaaccaga tggttacgag ctttttttgtg gagaatgaga 240
atttattttc caagactgac tcgtcgtttg cttgtaaaag atgattatga tgttgaagtt 300
tcttttacca ttatgaatcc accactgttg ttctctaaaa gaagagaagt caagaagata 360
tcttggattc atggaagtat tgaagaactt cttaaggata gctctaaaag agaatcacat 420
agaagccagt tggatgctgc gaatacaatt gtagggattt caaaaaagac cagcaattct 480

```
atcaaggaag tttatccaga ttatacttct aaattacaga caatctacaa tggatatgat 540
tttcagacta ttctagaaaa atctcaagag aagatcgata tcgagattgc tcctcaaagt 600
atctgtacta tcggacggat tgaggaaaat aagggttctg accgtgtagt ggaagtgata 660
cgattattac accaagaggg aaaaaactat catctctatt ttatcggggc tggtgatatg 720
gaagaggaac tgaaaaaacg agtcaaagag tatgggattg aggactatgt acatttcctt 780
ggttatcaaa aaaatcctta tcagtatcta tctcagacga aagttctttt gtctatgtct 840
aaacaagaag gttttcctgg agtgtatgtg gaggccttga gtctgggact ccctttttatc 900
tctacggacg ttggaggggc tgaggaatta tcccaagaag gacgatttgg acaaatcatt 960
gagagcaatc aagaggcagc tcaggcgatt actaattaca tgacttctgc ctcaaacttt 1020
gatgtcgatg aggctagcca attcattcaa caatttacaa ttacaaaaca aatcgaacaa 1080
gtagaaaaac tattagagga gtag                                        1104
```

<210> 46
<211> 367
<212> PRT
<213> Streptococcus pneumoniae

<400> 46

```
Met Val Ala Lys Lys Lys Ile Leu Phe Phe Met Trp Ser Phe Ser Leu
  1               5                  10                  15

Gly Gly Gly Ala Glu Lys Ile Leu Ser Thr Ile Val Ser Asn Leu Asp
             20                  25                  30

Pro Glu Lys Tyr Asp Ile Asp Ile Leu Glu Met Glu His Phe Asp Lys
         35                  40                  45

Gly Tyr Glu Ser Val Pro Lys His Val Arg Ile Leu Lys Ser Leu Gln
     50                  55                  60

Asp Tyr Arg Gln Thr Arg Trp Leu Arg Ala Phe Leu Trp Arg Met Arg
 65                  70                  75                  80

Ile Tyr Phe Pro Arg Leu Thr Arg Arg Leu Leu Val Lys Asp Asp Tyr
                 85                  90                  95

Asp Val Glu Val Ser Phe Thr Ile Met Asn Pro Pro Leu Leu Phe Ser
            100                 105                 110

Lys Arg Arg Glu Val Lys Lys Ile Ser Trp Ile His Gly Ser Ile Glu
        115                 120                 125

Glu Leu Leu Lys Asp Ser Ser Lys Arg Glu Ser His Arg Ser Gln Leu
    130                 135                 140

Asp Ala Ala Asn Thr Ile Val Gly Ile Ser Lys Lys Thr Ser Asn Ser
145                 150                 155                 160

Ile Lys Glu Val Tyr Pro Asp Tyr Thr Ser Lys Leu Gln Thr Ile Tyr
                165                 170                 175

Asn Gly Tyr Asp Phe Gln Thr Ile Leu Glu Lys Ser Gln Glu Lys Ile
            180                 185                 190

Asp Ile Glu Ile Ala Pro Gln Ser Ile Cys Thr Ile Gly Arg Ile Glu
        195                 200                 205
```

```
Glu Asn Lys Gly Ser Asp Arg Val Val Glu Val Ile Arg Leu Leu His
    210                 215                 220

Gln Glu Gly Lys Asn Tyr His Leu Tyr Phe Ile Gly Ala Gly Asp Met
225                 230                 235                 240

Glu Glu Glu Leu Lys Lys Arg Val Lys Glu Tyr Gly Ile Glu Asp Tyr
                245                 250                 255

Val His Phe Leu Gly Tyr Gln Lys Asn Pro Tyr Gln Tyr Leu Ser Gln
            260                 265                 270

Thr Lys Val Leu Leu Ser Met Ser Lys Gln Glu Gly Phe Pro Gly Val
        275                 280                 285

Tyr Val Glu Ala Leu Ser Leu Gly Leu Pro Phe Ile Ser Thr Asp Val
    290                 295                 300

Gly Gly Ala Glu Glu Leu Ser Gln Glu Gly Arg Phe Gly Gln Ile Ile
305                 310                 315                 320

Glu Ser Asn Gln Glu Ala Ala Gln Ala Ile Thr Asn Tyr Met Thr Ser
                325                 330                 335

Ala Ser Asn Phe Asp Val Asp Glu Ala Ser Gln Phe Ile Gln Gln Phe
            340                 345                 350

Thr Ile Thr Lys Gln Ile Glu Gln Val Glu Lys Leu Leu Glu Glu
        355                 360                 365
```

<210> 47
<211> 987
<212> DNA
<213> Streptococcus pneumoniae

<400> 47
atggaaactg cattaattag tgtgattgtg ccagtctata atgtggcgca gtacctagaa 60
aaatcgatag cttccattca gaagcagacc tatcaaaatc tggaaattat tcttgttgat 120
gatggtgcaa cagatgaaag tggtcgcttg tgtgattcaa tcgctgaaca agatgacagg 180
gtgtcagtgc ttcataaaaa gaacgaagga ttgtcgcaag cacgaaatga tgggatgaag 240
caggctcacg gggattatct gatttttatt gactcagatg attatatcca tccagaaatg 300
attcagagct tatatgagca attagttcaa gaagatgcgg atgtttcgag ctgtggtgtc 360
atgaatgtct atgctaatga tgaaagccca cagtcagcca atcaggatga ctattttgtc 420
tgtgattctc aaacatttct aaaggaatac ctcataggtg aaaaaatacc tgggacgatt 480
tgcaataagc taatcaagag acagattgca actgccctat cctttcctaa ggggttgatt 540
tacgaagatg cctattacca ttttgattta atcaagttgg ccaagaagta tgtggttaat 600
actaaaccct attattacta tttccataga ggggatagta ttacgaccaa accctatgca 660
gagaaggatt tagcctatat tgatatctac caaaagtttt ataatgaagt tgtgaaaaac 720
tatcctgact tgaaagaggt cgctttttc agattggcct atgcccactt ctttattctg 780
gataagatgt tgctagatga tcagtataaa cagtttgaag cctattctca gattcatcgt 840
tttttaaaag gccatgcctt tgctatttct aggaatccaa ttttccgtaa ggggagaaga 900
attagtgctt tggccctatt cataaatatt tccttatatc gattcttatt actgaaaaat 960
attgaaaaat ctaaaaaatt acattag 987

<210> 48
<211> 328
<212> PRT
<213> Streptococcus pneumoniae

<400> 48
Met Glu Thr Ala Leu Ile Ser Val Ile Val Pro Val Tyr Asn Val Ala
1 5 10 15

Gln Tyr Leu Glu Lys Ser Ile Ala Ser Ile Gln Lys Gln Thr Tyr Gln
20 25 30

Asn Leu Glu Ile Ile Leu Val Asp Asp Gly Ala Thr Asp Glu Ser Gly
35 40 45

Arg Leu Cys Asp Ser Ile Ala Glu Gln Asp Asp Arg Val Ser Val Leu
50 55 60

His Lys Lys Asn Glu Gly Leu Ser Gln Ala Arg Asn Asp Gly Met Lys
65 70 75 80

Gln Ala His Gly Asp Tyr Leu Ile Phe Ile Asp Ser Asp Asp Tyr Ile
85 90 95

His Pro Glu Met Ile Gln Ser Leu Tyr Glu Gln Leu Val Gln Glu Asp
100 105 110

Ala Asp Val Ser Ser Cys Gly Val Met Asn Val Tyr Ala Asn Asp Glu
115 120 125

Ser Pro Gln Ser Ala Asn Gln Asp Asp Tyr Phe Val Cys Asp Ser Gln
130 135 140

Thr Phe Leu Lys Glu Tyr Leu Ile Gly Glu Lys Ile Pro Gly Thr Ile
145 150 155 160

Cys Asn Lys Leu Ile Lys Arg Gln Ile Ala Thr Ala Leu Ser Phe Pro
165 170 175

Lys Gly Leu Ile Tyr Glu Asp Ala Tyr Tyr His Phe Asp Leu Ile Lys
180 185 190

Leu Ala Lys Lys Tyr Val Val Asn Thr Lys Pro Tyr Tyr Tyr Tyr Phe
195 200 205

His Arg Gly Asp Ser Ile Thr Thr Lys Pro Tyr Ala Glu Lys Asp Leu
210 215 220

Ala Tyr Ile Asp Ile Tyr Gln Lys Phe Tyr Asn Glu Val Val Lys Asn
225 230 235 240

Tyr Pro Asp Leu Lys Glu Val Ala Phe Phe Arg Leu Ala Tyr Ala His
245 250 255

Phe Phe Ile Leu Asp Lys Met Leu Leu Asp Asp Gln Tyr Lys Gln Phe
260 265 270

```
Glu Ala Tyr Ser Gln Ile His Arg Phe Leu Lys Gly His Ala Phe Ala
        275                 280                 285

Ile Ser Arg Asn Pro Ile Phe Arg Lys Gly Arg Arg Ile Ser Ala Leu
    290                 295                 300

Ala Leu Phe Ile Asn Ile Ser Leu Tyr Arg Phe Leu Leu Leu Lys Asn
305                 310                 315                 320

Ile Glu Lys Ser Lys Lys Leu His
                325
```

<210> 49
<211> 735
<212> DNA
<213> Streptococcus pneumoniae

<400> 49
atgagaatca aagagaaaac caataatatt aatggaggaa taaaaaatgt aagtaagcat 60
tatggtcatt caatcattct caaagatata aattttgcac ttaacaaggg tgaaattgtt 120
ggtctagcag ggagaaatgg agttggtaag agtacgttga tgaaaattct tgttcagaat 180
aatcaaccga cttcaggtaa tattataagc agtgataatg ttgggtattt aatcgaagaa 240
ccaaaattat ttttatctaa aacaggttta gagaatttaa aatatttgtc aaatttatat 300
ggtgttgact acaatcaaga aagatttaga tgtttgatcc aagagttaga tttgactcag 360
tctattaata aaaaagtaaa gacctattct ttgggtacaa aacaaaaatt agctttgctt 420
ctaactctcg ttacggaacc tgatatattg attttagatg aaccgactaa tggtttagat 480
attgaatcat cacaaatagt tttagcggtt ctaaaaaaat tagctttaca tgaaaatgtg 540
ggaattttaa tatcgagtca taaattagaa gacattgaag aaatttgtga gagagttctt 600
ttcttggaga acgggctttt gacatttcaa aaagtaggaa aagatagtca taatttcttg 660
tttgagatag ctttttcatc agctacagat agagacattt tcattaccaa acaagaattt 720
tgggatattg tttag 735

<210> 50
<211> 244
<212> PRT
<213> Streptococcus pneumoniae

<400> 50
```
Met Arg Ile Lys Glu Lys Thr Asn Asn Ile Asn Gly Gly Ile Lys Asn
  1               5                  10                  15

Val Ser Lys His Tyr Gly His Ser Ile Ile Leu Lys Asp Ile Asn Phe
             20                  25                  30

Ala Leu Asn Lys Gly Glu Ile Val Gly Leu Ala Gly Arg Asn Gly Val
         35                  40                  45

Gly Lys Ser Thr Leu Met Lys Ile Leu Val Gln Asn Asn Gln Pro Thr
     50                  55                  60

Ser Gly Asn Ile Ile Ser Ser Asp Asn Val Gly Tyr Leu Ile Glu Glu
 65                  70                  75                  80
```

```
Pro Lys Leu Phe Leu Ser Lys Thr Gly Leu Glu Asn Leu Lys Tyr Leu
                 85                  90                  95

Ser Asn Leu Tyr Gly Val Asp Tyr Asn Gln Glu Arg Phe Arg Cys Leu
            100                 105                 110

Ile Gln Glu Leu Asp Leu Thr Gln Ser Ile Asn Lys Lys Val Lys Thr
        115                 120                 125

Tyr Ser Leu Gly Thr Lys Gln Lys Leu Ala Leu Leu Leu Thr Leu Val
    130                 135                 140

Thr Glu Pro Asp Ile Leu Ile Leu Asp Glu Pro Thr Asn Gly Leu Asp
145                 150                 155                 160

Ile Glu Ser Ser Gln Ile Val Leu Ala Val Leu Lys Lys Leu Ala Leu
                165                 170                 175

His Glu Asn Val Gly Ile Leu Ile Ser Ser His Lys Leu Glu Asp Ile
            180                 185                 190

Glu Glu Ile Cys Glu Arg Val Leu Phe Leu Glu Asn Gly Leu Leu Thr
        195                 200                 205

Phe Gln Lys Val Gly Lys Asp Ser His Asn Phe Leu Phe Glu Ile Ala
    210                 215                 220

Phe Ser Ser Ala Thr Asp Arg Asp Ile Phe Ile Thr Lys Gln Glu Phe
225                 230                 235                 240

Trp Asp Ile Val
```

<210> 51
<211> 1704
<212> DNA
<213> Streptococcus pneumoniae

<400> 51

```
atgactgaat tagataaacg tcaccgcagt agcatttatg acagcatggt taaatcacct 60
aaccgtgcta tgcttcgtgc gactggtatg acagataagg actttgaaac atcgattgtg 120
ggagtgattt cgacttgggc ggaaaataca ccatgtaaca ttcacttgca tgatttcggg 180
aaactggcta aagaaggtgt caaatctgca ggcgcttggc ctgtacagtt tggaaccatt 240
accgtagcgg acgggatcgc tatgggaacg cctggtatgc gtttctctct aacatctcgt 300
gacatcatcg cggactccat cgaggcggct atgagtggtc acaacgtgga tgccttcgtc 360
gctatcggtg gctgtgacaa gaacatgcct ggatctatga ttgctattgc taatatggat 420
atcccagcta ttttcgccta tggtggaact attgcaccgg gaaatcttga tggtaaagat 480
atcgacttgg tttctgtctt tgaaggtatc ggaaaatgga accacggtga catgacagct 540
gaggacgtga aacgtcttga atgtaatgcc tgccctggcc ctggtggttg tggtggtatg 600
tatactgcta ataccatggc aactgctatc gaagttctag ggatgagttt gccagggtca 660
tcctctcacc cagctgaatc agctgataag aaagaagata tcgaagcagc aggacgtgct 720
gttgttaaga tgttggaact tggtctcaaa ccatcagata tcttgactcg tgaagccttt 780
gaagatgcta tcactgtaac gatggctctc ggtggttcta caaacgccac tcttcacttg 840
ctcgccattg cccatgccgc aaatgttgac ttgtcacttg aggacttcaa tacgattcaa 900
gaacgtgtgc ctcacttggc cgacttgaaa ccatctggtc agtatgtctt ccaagacctc 960
```

```
tacgaagtcg gtggtgtccc tgcggttatg aagtatttgt tggcaaatgg tttccttcac 1020
ggagatcgca tcacatgtac tggtaagact gtagctgaaa acttggctga ctttgcagac 1080
ttgactccag gccaaaaagt tatcatgcca cttgaaaatc caaaacgtgc ggatggtccg 1140
cttatcatct tgaacgggaa ccttgctcct gacggtgcag ttgccaaggt atcaggtgtt 1200
aaagtgcgtc gtcacgttgg gccagctaag gtctttgact cagaagaaga tgcgattcag 1260
gccgttctga cagatgaaat cgttgatggc gatgtagtcg ttgttcgttt tgttggacct 1320
aaaggtggtc ctggtatgcc tgagatgcta tcactttctt caatgattgt tggtaaaggt 1380
cagggagata aggtggccct cttgacggac ggacgtttct ctggtggtac ttatggtctg 1440
gttgttggac atatcgctcc tgaagctcag gatggtggac caattgccta tctccgtacc 1500
ggcgatatcg ttacggttga ccaagatacc aaagaaattt ctatggccgt atccgaagaa 1560
gaacttgaaa aacgcaaggc agaaacaacc ttgccaccac tttacagccg tggtgtcctc 1620
ggtaaatatg cccacatcgt atcatctgct tcacgcggag ccgtgacaga cttctggaat 1680
atggacaagt caggtaaaaa ataa                                       1704
```

<210> 52
<211> 567
<212> PRT
<213> Streptococcus pneumoniae

<400> 52

```
Met Thr Glu Leu Asp Lys Arg His Arg Ser Ser Ile Tyr Asp Ser Met
  1               5                  10                  15

Val Lys Ser Pro Asn Arg Ala Met Leu Arg Ala Thr Gly Met Thr Asp
             20                  25                  30

Lys Asp Phe Glu Thr Ser Ile Val Gly Val Ile Ser Thr Trp Ala Glu
         35                  40                  45

Asn Thr Pro Cys Asn Ile His Leu His Asp Phe Gly Lys Leu Ala Lys
     50                  55                  60

Glu Gly Val Lys Ser Ala Gly Ala Trp Pro Val Gln Phe Gly Thr Ile
 65                  70                  75                  80

Thr Val Ala Asp Gly Ile Ala Met Gly Thr Pro Gly Met Arg Phe Ser
                 85                  90                  95

Leu Thr Ser Arg Asp Ile Ile Ala Asp Ser Ile Glu Ala Ala Met Ser
            100                 105                 110

Gly His Asn Val Asp Ala Phe Val Ala Ile Gly Gly Cys Asp Lys Asn
        115                 120                 125

Met Pro Gly Ser Met Ile Ala Ile Ala Asn Met Asp Ile Pro Ala Ile
    130                 135                 140

Phe Ala Tyr Gly Gly Thr Ile Ala Pro Gly Asn Leu Asp Gly Lys Asp
145                 150                 155                 160

Ile Asp Leu Val Ser Val Phe Glu Gly Ile Gly Lys Trp Asn His Gly
                165                 170                 175

Asp Met Thr Ala Glu Asp Val Lys Arg Leu Glu Cys Asn Ala Cys Pro
            180                 185                 190
```

Gly Pro Gly Gly Cys Gly Gly Met Tyr Thr Ala Asn Thr Met Ala Thr
195 200 205

Ala Ile Glu Val Leu Gly Met Ser Leu Pro Gly Ser Ser Ser His Pro
210 215 220

Ala Glu Ser Ala Asp Lys Lys Glu Asp Ile Glu Ala Ala Gly Arg Ala
225 230 235 240

Val Val Lys Met Leu Glu Leu Gly Leu Lys Pro Ser Asp Ile Leu Thr
245 250 255

Arg Glu Ala Phe Glu Asp Ala Ile Thr Val Thr Met Ala Leu Gly Gly
260 265 270

Ser Thr Asn Ala Thr Leu His Leu Leu Ala Ile Ala His Ala Ala Asn
275 280 285

Val Asp Leu Ser Leu Glu Asp Phe Asn Thr Ile Gln Glu Arg Val Pro
290 295 300

His Leu Ala Asp Leu Lys Pro Ser Gly Gln Tyr Val Phe Gln Asp Leu
305 310 315 320

Tyr Glu Val Gly Gly Val Pro Ala Val Met Lys Tyr Leu Leu Ala Asn
325 330 335

Gly Phe Leu His Gly Asp Arg Ile Thr Cys Thr Gly Lys Thr Val Ala
340 345 350

Glu Asn Leu Ala Asp Phe Ala Asp Leu Thr Pro Gly Gln Lys Val Ile
355 360 365

Met Pro Leu Glu Asn Pro Lys Arg Ala Asp Gly Pro Leu Ile Ile Leu
370 375 380

Asn Gly Asn Leu Ala Pro Asp Gly Ala Val Ala Lys Val Ser Gly Val
385 390 395 400

Lys Val Arg Arg His Val Gly Pro Ala Lys Val Phe Asp Ser Glu Glu
405 410 415

Asp Ala Ile Gln Ala Val Leu Thr Asp Glu Ile Val Asp Gly Asp Val
420 425 430

Val Val Val Arg Phe Val Gly Pro Lys Gly Gly Pro Gly Met Pro Glu
435 440 445

Met Leu Ser Leu Ser Ser Met Ile Val Gly Lys Gly Gln Gly Asp Lys
450 455 460

Val Ala Leu Leu Thr Asp Gly Arg Phe Ser Gly Gly Thr Tyr Gly Leu
465 470 475 480

Val Val Gly His Ile Ala Pro Glu Ala Gln Asp Gly Gly Pro Ile Ala
485 490 495

```
Tyr Leu Arg Thr Gly Asp Ile Val Thr Val Asp Gln Asp Thr Lys Glu
            500                 505                 510

Ile Ser Met Ala Val Ser Glu Glu Glu Leu Glu Lys Arg Lys Ala Glu
        515                 520                 525

Thr Thr Leu Pro Pro Leu Tyr Ser Arg Gly Val Leu Gly Lys Tyr Ala
    530                 535                 540

His Ile Val Ser Ser Ala Ser Arg Gly Ala Val Thr Asp Phe Trp Asn
545                 550                 555                 560

Met Asp Lys Ser Gly Lys Lys
                565
```

<210> 53
<211> 274
<212> DNA
<213> Streptococcus pneumoniae

<400> 53
atgttataat aaaaataaag aatttaagga gaaatacaat atgtcaattt ttattggagg 60
agcatggcca tatgcaaacg gttcgttaca tattggtcac gcggcagcgc ttttaccggg 120
ggatattctt gcaagatact atcgtcagaa gggagaggaa gttttatatg tttctggaag 180
tgattgtaat ggaaccccta tttctatcag agctaaaaaa gaaaataagt ctgtgaaaga 240
aattgctgat ttttatcata aggaatttaa tcca 274

<210> 54
<211> 91
<212> PRT
<213> Streptococcus pneumoniae

<400> 54
```
Cys Tyr Asn Lys Asn Lys Glu Phe Lys Glu Lys Tyr Asn Met Ser Ile
  1               5                  10                  15

Phe Ile Gly Gly Ala Trp Pro Tyr Ala Asn Gly Ser Leu His Ile Gly
            20                  25                  30

His Ala Ala Ala Leu Leu Pro Gly Asp Ile Leu Ala Arg Tyr Tyr Arg
        35                  40                  45

Gln Lys Gly Glu Glu Val Leu Tyr Val Ser Gly Ser Asp Cys Asn Gly
    50                  55                  60

Thr Pro Ile Ser Ile Arg Ala Lys Lys Glu Asn Lys Ser Val Lys Glu
65                  70                  75                  80

Ile Ala Asp Phe Tyr His Lys Glu Phe Asn Pro
                85                  90
```

<210> 55

<211> 1065
<212> DNA
<213> Streptococcus pneumoniae

<400> 55
atgacaacat tattttcaaa aattaaagaa gtaacagaac ttgctgcagt ctcaggtcat 60
gaagcgcctg tccgtgctta tcttcgtgaa aagttgacac cgcatgtgga tgaagtggtg 120
acagatggct tgggtggtat ttttggtatc aaacattcag aagctgtgga tgcaccgcgc 180
gtcttggtcg cttctcatat ggacgaagtt ggttttatgg tcagcgaaat caagccagat 240
ggtaccttcc gtgtcgtaga aatcggtggc tggaacccca tggtggttag cagccaacgt 300
ttcaaactct tgactcgtga tggtcatgaa attcctgtga tttcaggttc tgttcctccg 360
catttgactc gtggaaaggg gggaccaacc atgccagcca ttgccgatat cgtttttgat 420
ggtggttttg cggacaaggc tgaggcagaa agttttggca tccgtcctgg tgataccatt 480
gtaccagata gttctgcaat tttgacagcc aatgaaaaaa atatcatctc aaaagcttgg 540
gataaccgct acggtgtcct catggtaagc gagctagctg aagctttatc gggtcaaaaa 600
ctcggcaatg aactctatct gggttctaac gtccaagaag aagttggtct gcgtggcgct 660
catacctcta caaccaagtt tgacccagaa gtcttcctcg cagttgattg ctcaccagca 720
ggtgatgtct acggtggtca aggcaagatt ggagatggaa ccttgattcg tttctatgat 780
ccaggtcact tgcttctccc agggatgaag gatttccttt tgacaacggc tgaagaagct 840
ggtatcaagt accaatacta ctgtggtaaa ggcggaacag atgcaggtgc agctcatctg 900
aaaaatggtg gtgtcccatc aacaactatc ggtgtctgcg ctcgttatat ccattctcac 960
caaaccctct atgcaatgga tgacttccta gaagcgcaag ctttcttaca agccttggtg 1020
aagaaattgg atcgttcaac ggttgatttg attaaacatt attaa 1065

<210> 56
<211> 354
<212> PRT
<213> Streptococcus pneumoniae

<400> 56
Met Thr Thr Leu Phe Ser Lys Ile Lys Glu Val Thr Glu Leu Ala Ala
1 5 10 15

Val Ser Gly His Glu Ala Pro Val Arg Ala Tyr Leu Arg Glu Lys Leu
20 25 30

Thr Pro His Val Asp Glu Val Val Thr Asp Gly Leu Gly Gly Ile Phe
35 40 45

Gly Ile Lys His Ser Glu Ala Val Asp Ala Pro Arg Val Leu Val Ala
50 55 60

Ser His Met Asp Glu Val Gly Phe Met Val Ser Glu Ile Lys Pro Asp
65 70 75 80

Gly Thr Phe Arg Val Val Glu Ile Gly Gly Trp Asn Pro Met Val Val
85 90 95

Ser Ser Gln Arg Phe Lys Leu Leu Thr Arg Asp Gly His Glu Ile Pro
100 105 110

Val Ile Ser Gly Ser Val Pro Pro His Leu Thr Arg Gly Lys Gly Gly
115 120 125

Pro Thr Met Pro Ala Ile Ala Asp Ile Val Phe Asp Gly Gly Phe Ala
130 135 140

```
Asp Lys Ala Glu Ala Glu Ser Phe Gly Ile Arg Pro Gly Asp Thr Ile
145                 150                 155                 160

Val Pro Asp Ser Ser Ala Ile Leu Thr Ala Asn Glu Lys Asn Ile Ile
                165                 170                 175

Ser Lys Ala Trp Asp Asn Arg Tyr Gly Val Leu Met Val Ser Glu Leu
            180                 185                 190

Ala Glu Ala Leu Ser Gly Gln Lys Leu Gly Asn Glu Leu Tyr Leu Gly
        195                 200                 205

Ser Asn Val Gln Glu Glu Val Gly Leu Arg Gly Ala His Thr Ser Thr
    210                 215                 220

Thr Lys Phe Asp Pro Glu Val Phe Leu Ala Val Asp Cys Ser Pro Ala
225                 230                 235                 240

Gly Asp Val Tyr Gly Gly Gln Gly Lys Ile Gly Asp Gly Thr Leu Ile
                245                 250                 255

Arg Phe Tyr Asp Pro Gly His Leu Leu Leu Pro Gly Met Lys Asp Phe
            260                 265                 270

Leu Leu Thr Thr Ala Glu Glu Ala Gly Ile Lys Tyr Gln Tyr Tyr Cys
        275                 280                 285

Gly Lys Gly Gly Thr Asp Ala Gly Ala Ala His Leu Lys Asn Gly Gly
    290                 295                 300

Val Pro Ser Thr Thr Ile Gly Val Cys Ala Arg Tyr Ile His Ser His
305                 310                 315                 320

Gln Thr Leu Tyr Ala Met Asp Asp Phe Leu Glu Ala Gln Ala Phe Leu
                325                 330                 335

Gln Ala Leu Val Lys Lys Leu Asp Arg Ser Thr Val Asp Leu Ile Lys
            340                 345                 350

His Tyr
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<210> 57
<211> 1182
<212> DNA
<213> Streptococcus pneumoniae

<400> 57
atggaatttt ctatgaaatc agtcaaagga ctactcttta tcatagctag ttttatcttg 60
actcttttga cttggatgaa cacttctccc caattcatga ttccaggact agctttaaca 120
agcctatctc tgacttttat cctagccact cgtctcccac tactagaaag ctggtttcac 180
agtttggaga aggtctacac cgtccacaaa ttcacagcct ttctctcaat catcctacta 240
atctttcata actttagtat gggcggtttg tggggctctc gcttagctgc tcagtttggc 300
aatcttgcca tctatatctt tgccagcatc atccttgtcg cctatttagg caaatacatc 360

caatacgaag cttggcgatg gattcaccgc ctggtttacc tagcctatat tttaggactc 420
tttcacatct acatgataat gggcaatcgt ctccttacat ttaatcttct aagttttctt 480
gttggtagct atgccctttt aggcttacta gctggttttt atatcatttt tctatatcaa 540
aagatttcct tcccctatct agggaaaatt acccatctca aacgcttaaa tcacgatact 600
agagaaattc aaatccatct tagcagacct ttcaactatc aatcaggaca atttgccttt 660
ctaaagattt tccaagaagg ctttgaaagt gctccgcatc ccttttctat ctcaggaggt 720
catggtcaaa ctctttactt tactgttaaa acttcaggcg accataccaa gaatatctat 780
gataatcttc aagccggcag caaagtaacc ctagacagag cttacggaca catgatcata 840
gaagaaggac gagaaaatca ggtttggatt gctggaggta ttgggatcac ccccttcatc 900
tcttacatcc gtgaacatcc tattttagat aaacaggttc acttctacta tagcttccgt 960
ggagatgaaa atgcagtcta cctagattta ctccgtaact atgctcagaa aaatcctaat 1020
tttgaactcc atctaatcga cagtacgaaa gacggctatc ttaattttga acaaaaagaa 1080
gtgcccgaac atgcaaccgt ctatatgtgt ggtcctattt ctatgatgaa ggcacttgcc 1140
aaacagatta agaaacaaaa tccaaaaaca gagcatattt ac 1182

<210> 58
<211> 394
<212> PRT
<213> Streptococcus pneumoniae

<400> 58
Met Glu Phe Ser Met Lys Ser Val Lys Gly Leu Leu Phe Ile Ile Ala
1 5 10 15

Ser Phe Ile Leu Thr Leu Leu Thr Trp Met Asn Thr Ser Pro Gln Phe
20 25 30

Met Ile Pro Gly Leu Ala Leu Thr Ser Leu Ser Leu Thr Phe Ile Leu
35 40 45

Ala Thr Arg Leu Pro Leu Leu Glu Ser Trp Phe His Ser Leu Glu Lys
50 55 60

Val Tyr Thr Val His Lys Phe Thr Ala Phe Leu Ser Ile Ile Leu Leu
65 70 75 80

Ile Phe His Asn Phe Ser Met Gly Gly Leu Trp Gly Ser Arg Leu Ala
85 90 95

Ala Gln Phe Gly Asn Leu Ala Ile Tyr Ile Phe Ala Ser Ile Ile Leu
100 105 110

Val Ala Tyr Leu Gly Lys Tyr Ile Gln Tyr Glu Ala Trp Arg Trp Ile
115 120 125

His Arg Leu Val Tyr Leu Ala Tyr Ile Leu Gly Leu Phe His Ile Tyr
130 135 140

Met Ile Met Gly Asn Arg Leu Leu Thr Phe Asn Leu Leu Ser Phe Leu
145 150 155 160

Val Gly Ser Tyr Ala Leu Leu Gly Leu Leu Ala Gly Phe Tyr Ile Ile
165 170 175

Phe Leu Tyr Gln Lys Ile Ser Phe Pro Tyr Leu Gly Lys Ile Thr His
180 185 190

```
Leu Lys Arg Leu Asn His Asp Thr Arg Glu Ile Gln Ile His Leu Ser
        195                 200                 205

Arg Pro Phe Asn Tyr Gln Ser Gly Gln Phe Ala Phe Leu Lys Ile Phe
    210                 215                 220

Gln Glu Gly Phe Glu Ser Ala Pro His Pro Phe Ser Ile Ser Gly Gly
225                 230                 235                 240

His Gly Gln Thr Leu Tyr Phe Thr Val Lys Thr Ser Gly Asp His Thr
                245                 250                 255

Lys Asn Ile Tyr Asp Asn Leu Gln Ala Gly Ser Lys Val Thr Leu Asp
            260                 265                 270

Arg Ala Tyr Gly His Met Ile Ile Glu Glu Gly Arg Glu Asn Gln Val
        275                 280                 285

Trp Ile Ala Gly Gly Ile Gly Ile Thr Pro Phe Ile Ser Tyr Ile Arg
    290                 295                 300

Glu His Pro Ile Leu Asp Lys Gln Val His Phe Tyr Tyr Ser Phe Arg
305                 310                 315                 320

Gly Asp Glu Asn Ala Val Tyr Leu Asp Leu Leu Arg Asn Tyr Ala Gln
                325                 330                 335

Lys Asn Pro Asn Phe Glu Leu His Leu Ile Asp Ser Thr Lys Asp Gly
            340                 345                 350

Tyr Leu Asn Phe Glu Gln Lys Glu Val Pro Glu His Ala Thr Val Tyr
        355                 360                 365

Met Cys Gly Pro Ile Ser Met Met Lys Ala Leu Ala Lys Gln Ile Lys
    370                 375                 380

Lys Gln Asn Pro Lys Thr Glu His Ile Tyr
385                 390
```

<210> 59
<211> 900
<212> DNA
<213> Streptococcus pneumoniae

<400> 59
atgactttta aatcaggctt tgtagccatt ttaggacgtc ccaatgttgg gaagtcaacc 60
tttttaaatc acgttatggg gcaaaagatt gccatcatga gtgacaaggc gcagacaacg 120
cgcaataaaa tcatgggaat ttacacgact gataaggagc aaattgtctt tatcgacaca 180
ccagggattc acaagcctaa aacagctctc ggagatttca tggttgagtc tgcctacagt 240
acccttcgcg aagtggacac tgttcttttc atggtgcctg ctgatgaagc gcgtggtaag 300
ggggacgata tgattatcga gcgtctcaag gctgccaagg ttcctgtgat tttggtggtg 360
aataaaatcg ataaggtcca tccagaccag ctcttgtctc agattgatga cttccgtaat 420
caaatggact ttaaggaaat tgttccaatc tcagcccttc agggaaataa cgtgtctcgt 480
ctagtggata ttttgagtga aaatctggat gaaggtttcc aatatttccc gtctgatcaa 540

atcacagacc atccagaacg tttcttggtt tcagaaatgg ttcgcgagaa agtcttgcac 600
ctaactcgtg aagagattcc gcattctgta gcagtagttg ttgactctat gaaacgagac 660
gaagagacag acaaggttca catccgtgca accatcatgg tcgagcgcga tagccaaaaa 720
gggattatca tcggtaaagg tggcgctatg cttaagaaaa tcggtagcat ggcccgtcgt 780
gatatcgaac tcatgctagg agacaaggtc ttcctagaaa cctgggtcaa ggtcaagaaa 840
aactggcgcg ataaaaagct agatttggct gactttggct ataatgaaag agaatactaa 900

<210> 60
<211> 299
<212> PRT
<213> Streptococcus pneumoniae

<400> 60
Met Thr Phe Lys Ser Gly Phe Val Ala Ile Leu Gly Arg Pro Asn Val
1 5 10 15

Gly Lys Ser Thr Phe Leu Asn His Val Met Gly Gln Lys Ile Ala Ile
20 25 30

Met Ser Asp Lys Ala Gln Thr Thr Arg Asn Lys Ile Met Gly Ile Tyr
35 40 45

Thr Thr Asp Lys Glu Gln Ile Val Phe Ile Asp Thr Pro Gly Ile His
50 55 60

Lys Pro Lys Thr Ala Leu Gly Asp Phe Met Val Glu Ser Ala Tyr Ser
65 70 75 80

Thr Leu Arg Glu Val Asp Thr Val Leu Phe Met Val Pro Ala Asp Glu
85 90 95

Ala Arg Gly Lys Gly Asp Asp Met Ile Ile Glu Arg Leu Lys Ala Ala
100 105 110

Lys Val Pro Val Ile Leu Val Val Asn Lys Ile Asp Lys Val His Pro
115 120 125

Asp Gln Leu Leu Ser Gln Ile Asp Asp Phe Arg Asn Gln Met Asp Phe
130 135 140

Lys Glu Ile Val Pro Ile Ser Ala Leu Gln Gly Asn Asn Val Ser Arg
145 150 155 160

Leu Val Asp Ile Leu Ser Glu Asn Leu Asp Glu Gly Phe Gln Tyr Phe
165 170 175

Pro Ser Asp Gln Ile Thr Asp His Pro Glu Arg Phe Leu Val Ser Glu
180 185 190

Met Val Arg Glu Lys Val Leu His Leu Thr Arg Glu Glu Ile Pro His
195 200 205

Ser Val Ala Val Val Val Asp Ser Met Lys Arg Asp Glu Glu Thr Asp
210 215 220

Lys Val His Ile Arg Ala Thr Ile Met Val Glu Arg Asp Ser Gln Lys

```
225                 230                 235                 240

Gly Ile Ile Ile Gly Lys Gly Gly Ala Met Leu Lys Lys Ile Gly Ser
                245                 250                 255

Met Ala Arg Arg Asp Ile Glu Leu Met Leu Gly Asp Lys Val Phe Leu
            260                 265                 270

Glu Thr Trp Val Lys Val Lys Lys Asn Trp Arg Asp Lys Lys Leu Asp
        275                 280                 285

Leu Ala Asp Phe Gly Tyr Asn Glu Arg Glu Tyr
    290                 295
```

<210> 61
<211> 855
<212> DNA
<213> Streptococcus pneumoniae

<400> 61
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ctgcttcttg tttttacaga aggaggactt atgcctgaat tacctgaggt tgaaaccgtt 60
tgtcgtggct tagaaaaatt gattatagga aagaagattt cgagtataga aattcgctac 120
cccaagatga ttaagacgga tttggaagag tttcaaaggg aattgcctag tcagattatc 180
gagtcaatgg gacgtcgtgg aaaatatttg ctttttatc tgacagacaa ggtcttgatt 240
tcccatttgc ggatggaggg caagtatttt tactatccag accaaggacc tgaacgcaag 300
catgcccatg ttttctttca ttttgaagat ggtggcacgc ttgtttatga ggatgttcgc 360
aagtttggaa ccatggaact cttggtgcct gacctttag acgtctactt tatttctaaa 420
aaattaggtc ctgaaccaag cgaacaagac tttgatttac aggtctttca atctgccctt 480
gccaagtcca aaaagcctat caaatcccat ctcctagacc agaccttggt agctggactt 540
ggcaatatct atgtggatga ggttctctgg cgagctcagg ttcatccagc tagaccttcc 600
cagactttga cagcagaaga agcgactgcc attcatgacc agaccattgc tgttttgggc 660
caggctgttg aaaaaggtgg ctccaccatt cggacttata ccaatgcctt tggggaagat 720
ggaagcatgc aggactttca tcaggtctat gataagactg gtcaagaatg tgtacgctgt 780
ggtaccatca ttgagaaaat tcaactaggc ggacgtggaa cccacttttg tccaaactgt 840
caaaggaggg actga                                                  855
```

<210> 62
<211> 284
<212> PRT
<213> Streptococcus pneumoniae

<400> 62
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Met Leu Leu Val Phe Thr Glu Gly Gly Leu Met Pro Glu Leu Pro Glu
  1               5                  10                  15

Val Glu Thr Val Cys Arg Gly Leu Glu Lys Leu Ile Ile Gly Lys Lys
             20                  25                  30

Ile Ser Ser Ile Glu Ile Arg Tyr Pro Lys Met Ile Lys Thr Asp Leu
         35                  40                  45

Glu Glu Phe Gln Arg Glu Leu Pro Ser Gln Ile Ile Glu Ser Met Gly
     50                  55                  60
```

```
Arg Arg Gly Lys Tyr Leu Leu Phe Tyr Leu Thr Asp Lys Val Leu Ile
 65                  70                  75                  80

Ser His Leu Arg Met Glu Gly Lys Tyr Phe Tyr Tyr Pro Asp Gln Gly
                 85                  90                  95

Pro Glu Arg Lys His Ala His Val Phe Phe His Phe Glu Asp Gly Gly
            100                 105                 110

Thr Leu Val Tyr Glu Asp Val Arg Lys Phe Gly Thr Met Glu Leu Leu
        115                 120                 125

Val Pro Asp Leu Leu Asp Val Tyr Phe Ile Ser Lys Lys Leu Gly Pro
    130                 135                 140

Glu Pro Ser Glu Gln Asp Phe Asp Leu Gln Val Phe Gln Ser Ala Leu
145                 150                 155                 160

Ala Lys Ser Lys Lys Pro Ile Lys Ser His Leu Leu Asp Gln Thr Leu
                165                 170                 175

Val Ala Gly Leu Gly Asn Ile Tyr Val Asp Glu Val Leu Trp Arg Ala
            180                 185                 190

Gln Val His Pro Ala Arg Pro Ser Gln Thr Leu Thr Ala Glu Glu Ala
        195                 200                 205

Thr Ala Ile His Asp Gln Thr Ile Ala Val Leu Gly Gln Ala Val Glu
    210                 215                 220

Lys Gly Gly Ser Thr Ile Arg Thr Tyr Thr Asn Ala Phe Gly Glu Asp
225                 230                 235                 240

Gly Ser Met Gln Asp Phe His Gln Val Tyr Asp Lys Thr Gly Gln Glu
                245                 250                 255

Cys Val Arg Cys Gly Thr Ile Ile Glu Lys Ile Gln Leu Gly Gly Arg
            260                 265                 270

Gly Thr His Phe Cys Pro Asn Cys Gln Arg Arg Asp
        275                 280
```

<210> 63
<211> 633
<212> DNA
<213> Streptococcus pneumoniae

<400> 63
ttgtccaaac tgtcaaagga gggactgatg ggaaaaatca tcggaatcac tgggggaatt 60
gcctctggta agtcaactgt gacaaatttt ctaagacagc aaggctttca agtagtggat 120
gccgacgcag tcgtccacca actacagaaa cctggtggtc gtctgtttga ggctctagta 180
cagcactttg ggcaagaaat cattcttgaa aacggagaac tcaatcgccc tctcctagct 240
agtctcatct tttcaaatcc tgatgaacga gaatggtcta agcaaattca aggggagatt 300
atccgtgagg aactggctac tttgagagaa cagttggctc agacagaaga gattttcttc 360
atggatattc ccctactttt tgagcaggac tacagcgatt ggtttgctga gacttggttg 420

gtctatgtgg accgagatgc ccaagtggaa cgcttaatga aaagggacca gttgtccaaa 480
gatgaagctg agtctcgtct ggcagcccag tggcctttag aaaaaaagaa agatttggcc 540
agccaggttc ttgataataa tggcaatcag aaccagcttc ttaatcaagt gcatatcctt 600
cttgagggag gtaggcaaga tgacagagat taa 633

<210> 64
<211> 210
<212> PRT
<213> Streptococcus pneumoniae

<400> 64
Met Ser Lys Leu Ser Lys Glu Gly Leu Met Gly Lys Ile Ile Gly Ile
1 5 10 15

Thr Gly Gly Ile Ala Ser Gly Lys Ser Thr Val Thr Asn Phe Leu Arg
20 25 30

Gln Gln Gly Phe Gln Val Val Asp Ala Asp Ala Val Val His Gln Leu
35 40 45

Gln Lys Pro Gly Gly Arg Leu Phe Glu Ala Leu Val Gln His Phe Gly
50 55 60

Gln Glu Ile Ile Leu Glu Asn Gly Glu Leu Asn Arg Pro Leu Leu Ala
65 70 75 80

Ser Leu Ile Phe Ser Asn Pro Asp Glu Arg Glu Trp Ser Lys Gln Ile
85 90 95

Gln Gly Glu Ile Ile Arg Glu Glu Leu Ala Thr Leu Arg Glu Gln Leu
100 105 110

Ala Gln Thr Glu Glu Ile Phe Phe Met Asp Ile Pro Leu Leu Phe Glu
115 120 125

Gln Asp Tyr Ser Asp Trp Phe Ala Glu Thr Trp Leu Val Tyr Val Asp
130 135 140

Arg Asp Ala Gln Val Glu Arg Leu Met Lys Arg Asp Gln Leu Ser Lys
145 150 155 160

Asp Glu Ala Glu Ser Arg Leu Ala Ala Gln Trp Pro Leu Glu Lys Lys
165 170 175

Lys Asp Leu Ala Ser Gln Val Leu Asp Asn Asn Gly Asn Gln Asn Gln
180 185 190

Leu Leu Asn Gln Val His Ile Leu Leu Glu Gly Gly Arg Gln Asp Asp
195 200 205

Arg Asp
210

<210> 65

<211> 1269
<212> DNA
<213> Streptococcus pneumoniae

<400> 65
ttgataataa tggcaatcag aaccagcttc ttaatcaagt gcatatcctt cttgagggag 60
gtaggcaaga tgacagagat taactggaag gataatctgc gcattgcctg gtttggtaat 120
tttctgacag gagccagtat ttctttggtt gtaccttta tgcccatctt cgtggaaaat 180
ctaggtgtag ggagtcagca agtcgctttt tatgcaggct tagcaatttc tgtctctgct 240
atttccgcgg cgctcttttc tcctatttgg ggtattcttg ctgacaaata cggccgaaaa 300
cccatgatga ttcgggcagg tcttgctatg actatcacta tgggaggctt ggcctttgtc 360
ccaaatatct attggttaat ctttcttcgt ttactaaacg gtgtatttgc aggttttgtt 420
cctaatgcaa cggcactgat agccagtcag gttccaaagg agaaatcagg ctctgcctta 480
ggtactttgt ctacaggcgt agttgcaggt actctaactg gtccctttat tggtggcttt 540
atcgcagaat tatttggcat tcgtacagtt ttcttactgg ttggtagttt tctatttta 600
gctgctattt tgactatttg ctttatcaag gaagattttc aaccagtagc caaggaaaag 660
gctattccaa caaaggaatt atttacctcg gttaaatatc cctatctttt gctcaatctc 720
tttttaacca gttttgtcat ccaattttca gctcaatcga ttggccctat tttggctctt 780
tatgtacgcg acttagggca gacagagaat cttctttttg tctctggttt gattgtgtcc 840
agtatgggct tttccagcat gatgagtgca ggagtcatgg gcaagctagg tgacaaggtg 900
ggcaatcatc gtctcttggt tgtcgcccag ttttattcag tcatcatcta tctcctctgt 960
gccaatgcct ctagcccccc tcaactagga ctctatcgtt tcctctttgg attgggaacc 1020
ggtgccttga ttcccggggt taatgcccta ctcagcaaaa tgactcccaa agccggcatt 1080
tcgagggtct ttgccttcaa tcaggtattc ttttatctgg gaggtgttgt tggtcccatg 1140
gcaggttctg cagtagcagg tcaatttggc taccatgctg tcttttatgc gacaagcctt 1200
tgtgttgcct ttagttgtct ctttaacctg attcaatttc gaacattatt aaaagtaaag 1260
gaaatctag 1269

<210> 66
<211> 422
<212> PRT
<213> Streptococcus pneumoniae

<400> 66
Met Ile Ile Met Ala Ile Arg Thr Ser Phe Leu Ile Lys Cys Ile Ser
1 5 10 15

Phe Leu Arg Glu Val Gly Lys Met Thr Glu Ile Asn Trp Lys Asp Asn
20 25 30

Leu Arg Ile Ala Trp Phe Gly Asn Phe Leu Thr Gly Ala Ser Ile Ser
35 40 45

Leu Val Val Pro Phe Met Pro Ile Phe Val Glu Asn Leu Gly Val Gly
50 55 60

Ser Gln Gln Val Ala Phe Tyr Ala Gly Leu Ala Ile Ser Val Ser Ala
65 70 75 80

Ile Ser Ala Ala Leu Phe Ser Pro Ile Trp Gly Ile Leu Ala Asp Lys
85 90 95

Tyr Gly Arg Lys Pro Met Met Ile Arg Ala Gly Leu Ala Met Thr Ile
100 105 110

Thr Met Gly Gly Leu Ala Phe Val Pro Asn Ile Tyr Trp Leu Ile Phe

```
        115                 120                 125

Leu Arg Leu Leu Asn Gly Val Phe Ala Gly Phe Val Pro Asn Ala Thr
    130                 135                 140

Ala Leu Ile Ala Ser Gln Val Pro Lys Glu Lys Ser Gly Ser Ala Leu
145                 150                 155                 160

Gly Thr Leu Ser Thr Gly Val Val Ala Gly Thr Leu Thr Gly Pro Phe
                165                 170                 175

Ile Gly Gly Phe Ile Ala Glu Leu Phe Gly Ile Arg Thr Val Phe Leu
            180                 185                 190

Leu Val Gly Ser Phe Leu Phe Leu Ala Ala Ile Leu Thr Ile Cys Phe
        195                 200                 205

Ile Lys Glu Asp Phe Gln Pro Val Ala Lys Glu Lys Ala Ile Pro Thr
    210                 215                 220

Lys Glu Leu Phe Thr Ser Val Lys Tyr Pro Tyr Leu Leu Leu Asn Leu
225                 230                 235                 240

Phe Leu Thr Ser Phe Val Ile Gln Phe Ser Ala Gln Ser Ile Gly Pro
                245                 250                 255

Ile Leu Ala Leu Tyr Val Arg Asp Leu Gly Gln Thr Glu Asn Leu Leu
            260                 265                 270

Phe Val Ser Gly Leu Ile Val Ser Ser Met Gly Phe Ser Ser Met Met
        275                 280                 285

Ser Ala Gly Val Met Gly Lys Leu Gly Asp Lys Val Gly Asn His Arg
    290                 295                 300

Leu Leu Val Val Ala Gln Phe Tyr Ser Val Ile Ile Tyr Leu Leu Cys
305                 310                 315                 320

Ala Asn Ala Ser Ser Pro Leu Gln Leu Gly Leu Tyr Arg Phe Leu Phe
                325                 330                 335

Gly Leu Gly Thr Gly Ala Leu Ile Pro Gly Val Asn Ala Leu Leu Ser
            340                 345                 350

Lys Met Thr Pro Lys Ala Gly Ile Ser Arg Val Phe Ala Phe Asn Gln
        355                 360                 365

Val Phe Phe Tyr Leu Gly Gly Val Val Gly Pro Met Ala Gly Ser Ala
    370                 375                 380

Val Ala Gly Gln Phe Gly Tyr His Ala Val Phe Tyr Ala Thr Ser Leu
385                 390                 395                 400

Cys Val Ala Phe Ser Cys Leu Phe Asn Leu Ile Gln Phe Arg Thr Leu
                405                 410                 415

Leu Lys Val Lys Glu Ile
```

<210> 67
<211> 1311
<212> DNA
<213> Streptococcus pneumoniae

<400> 67
atggccctac caactattgc cattgtagga cgtcccaatg ttgggaaatc aaccctattt 60
aatcggatcg ctggtgagcg aatctccatt gtagaagatg tcgaaggagt gacacgtgac 120
cgtatttatg caacgggtga gtggctcaat cgttctttta gcatgattga tacaggagga 180
attgatgatg tcgatgctcc tttcatggaa caaatcaagc accaggcaga aattgccatg 240
gaagaagcag atgttatcgt ttttgtcgtg tctggtaagg aaggaattac tgatgcagac 300
gaatacgtag ctcgtaagct ttataagacc cacaaaccag ttatcctcgc agtcaacaag 360
gtggacaacc ctgagatgag aaatgatata tatgatttct atgctctcgg tttgggtgaa 420
ccattgccta tctcatctgt ccatggaatc ggtacagggg atgtgctaga tgcgatcgta 480
gaaaatcttc caaatgaata tgaggaagaa aatccagatg tcattaagtt tagcttgatt 540
ggtcgtccta acgttggaaa atcaagcttg atcaatgcta tcttgggaga agaccgtgtt 600
attgctagtc ctgttgctgg aacaactcgt gatgccattg atacccactt tacagataca 660
gatggtcaag agtttaccat gattgatacg gctggtatgc gtaagtctgg taaggtttat 720
gaaaatactg agaaatactc tgttatgcgt gccatgcgtg ctattgaccg ttcagatgtg 780
gtcttgatgg tcatcaatgc ggaagaaggc attcgtgagt acgacaagcg tatcgcagga 840
tttgcccatg aagctggtaa agggatgatt atcgtggtca acaagtggga tacgcttgaa 900
aaagataacc acactatgaa aaactgggaa gaagatatcc gtgagcagtt ccaatacctg 960
ccttacgcac cgattatctt tgtatcagct ttaaccaagc aacgtctcca caaacttcct 1020
gagatgatta agcaaatcag cgaaagtcaa aatacacgta ttccatcagc tgtcttgaac 1080
gatgtcatca tggatgccat tgccatcaac ccaacaccga cagacaaagg aaaacgtctc 1140
aagattttct atgcgaccca agtggcaacc aaaccaccaa cctttgtcat ctttgtcaat 1200
gaagaagaac tcatgcactt ttcttacctg cgtttcttgg aaaatcaaat ccgcaaggcc 1260
tttgtttttg agggaacacc gattcatctc atcgcaagaa aacgcaaata a 1311

<210> 68
<211> 436
<212> PRT
<213> Streptococcus pneumoniae

<400> 68
Met Ala Leu Pro Thr Ile Ala Ile Val Gly Arg Pro Asn Val Gly Lys
1 5 10 15

Ser Thr Leu Phe Asn Arg Ile Ala Gly Glu Arg Ile Ser Ile Val Glu
20 25 30

Asp Val Glu Gly Val Thr Arg Asp Arg Ile Tyr Ala Thr Gly Glu Trp
35 40 45

Leu Asn Arg Ser Phe Ser Met Ile Asp Thr Gly Gly Ile Asp Asp Val
50 55 60

Asp Ala Pro Phe Met Glu Gln Ile Lys His Gln Ala Glu Ile Ala Met
65 70 75 80

Glu Glu Ala Asp Val Ile Val Phe Val Val Ser Gly Lys Glu Gly Ile
85 90 95

```
Thr Asp Ala Asp Glu Tyr Val Ala Arg Lys Leu Tyr Lys Thr His Lys
            100                 105                 110

Pro Val Ile Leu Ala Val Asn Lys Val Asp Asn Pro Glu Met Arg Asn
        115                 120                 125

Asp Ile Tyr Asp Phe Tyr Ala Leu Gly Leu Gly Glu Pro Leu Pro Ile
    130                 135                 140

Ser Ser Val His Gly Ile Gly Thr Gly Asp Val Leu Asp Ala Ile Val
145                 150                 155                 160

Glu Asn Leu Pro Asn Glu Tyr Glu Glu Glu Asn Pro Asp Val Ile Lys
                165                 170                 175

Phe Ser Leu Ile Gly Arg Pro Asn Val Gly Lys Ser Ser Leu Ile Asn
            180                 185                 190

Ala Ile Leu Gly Glu Asp Arg Val Ile Ala Ser Pro Val Ala Gly Thr
        195                 200                 205

Thr Arg Asp Ala Ile Asp Thr His Phe Thr Asp Thr Asp Gly Gln Glu
    210                 215                 220

Phe Thr Met Ile Asp Thr Ala Gly Met Arg Lys Ser Gly Lys Val Tyr
225                 230                 235                 240

Glu Asn Thr Glu Lys Tyr Ser Val Met Arg Ala Met Arg Ala Ile Asp
                245                 250                 255

Arg Ser Asp Val Val Leu Met Val Ile Asn Ala Glu Glu Gly Ile Arg
            260                 265                 270

Glu Tyr Asp Lys Arg Ile Ala Gly Phe Ala His Glu Ala Gly Lys Gly
        275                 280                 285

Met Ile Ile Val Val Asn Lys Trp Asp Thr Leu Glu Lys Asp Asn His
    290                 295                 300

Thr Met Lys Asn Trp Glu Glu Asp Ile Arg Glu Gln Phe Gln Tyr Leu
305                 310                 315                 320

Pro Tyr Ala Pro Ile Ile Phe Val Ser Ala Leu Thr Lys Gln Arg Leu
                325                 330                 335

His Lys Leu Pro Glu Met Ile Lys Gln Ile Ser Glu Ser Gln Asn Thr
            340                 345                 350

Arg Ile Pro Ser Ala Val Leu Asn Asp Val Ile Met Asp Ala Ile Ala
        355                 360                 365

Ile Asn Pro Thr Pro Thr Asp Lys Gly Lys Arg Leu Lys Ile Phe Tyr
    370                 375                 380

Ala Thr Gln Val Ala Thr Lys Pro Pro Thr Phe Val Ile Phe Val Asn
385                 390                 395                 400
```

```
Glu Glu Glu Leu Met His Phe Ser Tyr Leu Arg Phe Leu Glu Asn Gln
                405                 410                 415

Ile Arg Lys Ala Phe Val Phe Glu Gly Thr Pro Ile His Leu Ile Ala
            420                 425                 430

Arg Lys Arg Lys
        435
```

<210> 69
<211> 714
<212> DNA
<213> Streptococcus pneumoniae

<400> 69
atgacagaaa ccattaaatt gatgaaggct catacttcag tgcgcaggtt taaagagcaa 60
gaaattcccc aagtagactt aaatgagatt ttgacagcag cccagatggc atcatcttgg 120
aagaatttcc aatcctactc tgtgattgtg gtacgaagtc aagagaagaa agatgccttg 180
tatgaattgg tacctcaaga agccattcgc cagtctgctg ttttccttct ctttgtcgga 240
gatttgaacc gagcagaaaa gggagcccga cttcataccg acaccttcca accccaaggt 300
gtggaaggtc tcttgattag ttcggtcgat gcagctcttg ctggacaaaa cgccttgttg 360
gcagctgaaa gcttgggcta tggtggtgtg attatcggtt tggttcgata caagtctgaa 420
gaagtggcag agctctttaa cctacctgac tacacctatt ctgtctttgg gatggcactg 480
ggtgtgccaa atcaacatca tgatatgaaa ccgagactgc cactagagaa tgttgtcttt 540
gaggaagaat accaagaaca gtcaactgag gcaatccaag cttatgaccg tgttcaggct 600
gactatgctg gggcgcgtgc gaccacaagc tggagtcagc gcctagcaga acagtttggt 660
caagctgaac caagctcaac tagaaaaaat cttgaacaga agaaattatt gtag   714

<210> 70
<211> 237
<212> PRT
<213> Streptococcus pneumoniae

<400> 70
```
Met Thr Glu Thr Ile Lys Leu Met Lys Ala His Thr Ser Val Arg Arg
  1               5                  10                  15

Phe Lys Glu Gln Glu Ile Pro Gln Val Asp Leu Asn Glu Ile Leu Thr
             20                  25                  30

Ala Ala Gln Met Ala Ser Ser Trp Lys Asn Phe Gln Ser Tyr Ser Val
         35                  40                  45

Ile Val Val Arg Ser Gln Glu Lys Lys Asp Ala Leu Tyr Glu Leu Val
     50                  55                  60

Pro Gln Glu Ala Ile Arg Gln Ser Ala Val Phe Leu Leu Phe Val Gly
 65                  70                  75                  80

Asp Leu Asn Arg Ala Glu Lys Gly Ala Arg Leu His Thr Asp Thr Phe
                 85                  90                  95

Gln Pro Gln Gly Val Glu Gly Leu Leu Ile Ser Ser Val Asp Ala Ala
```

```
            100                 105                 110

Leu Ala Gly Gln Asn Ala Leu Leu Ala Ala Glu Ser Leu Gly Tyr Gly
        115                 120                 125

Gly Val Ile Ile Gly Leu Val Arg Tyr Lys Ser Glu Glu Val Ala Glu
    130                 135                 140

Leu Phe Asn Leu Pro Asp Tyr Thr Tyr Ser Val Phe Gly Met Ala Leu
145                 150                 155                 160

Gly Val Pro Asn Gln His His Asp Met Lys Pro Arg Leu Pro Leu Glu
                165                 170                 175

Asn Val Val Phe Glu Glu Glu Tyr Gln Glu Gln Ser Thr Glu Ala Ile
            180                 185                 190

Gln Ala Tyr Asp Arg Val Gln Ala Asp Tyr Ala Gly Ala Arg Ala Thr
        195                 200                 205

Thr Ser Trp Ser Gln Arg Leu Ala Glu Gln Phe Gly Gln Ala Glu Pro
    210                 215                 220

Ser Ser Thr Arg Lys Asn Leu Glu Gln Lys Lys Leu Leu
225                 230                 235
```

<210> 71
<211> 729
<212> DNA
<213> Streptococcus pneumoniae

<400> 71
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atgacagaaa ttagactaga gcacgtcagt tatgcctatg gtcaggagag gattttagag 60
gatatcaacc tacaggtgac ttcaggcgaa gtggtttcca tcctaggccc aagtggtgtt 120
ggaaagacca ccctctttaa tctaatcgct gggattttag aagttcagtc agggagaatt 180
gtccttgatg gtgaagaaaa tcccaagggg cgcgtgagtt atatgttgca aaaggatctg 240
ctcttggagc acaagacggt gcttggaaat atcattctgc ccctcttgat tcaaaaggtg 300
gataaggcag aagctatttc ccgagcggat aaaattcttg cgaccttcca gctgacagct 360
gtaagagaca agtatcctca tgaacttagc ggtgggatgc gccagcgtgt agccttactc 420
cggacctacc tttttgggca caagctcttt ctcttagatg aggcctttag cgccttggat 480
gagatgacaa agatggaact ccacgcttgg tatcttgaga ttcacaagca gttgcagcta 540
acaaccctga tcatcacgca tagtattgag gaggccctca atctcagcga ccgtatctat 600
atcttgaaaa atcgccctgg gcagattgtt tcagaaatta aactagattg gtctgaagat 660
gaggacaagg aagtccaaaa gattgcctac aaacgtcaaa ttttggcgga attaggctta 720
gataagtag                                                        729
```

<210> 72
<211> 242
<212> PRT
<213> Streptococcus pneumoniae

<400> 72
```
Met Thr Glu Ile Arg Leu Glu His Val Ser Tyr Ala Tyr Gly Gln Glu
  1               5                  10                  15
```

```
Arg Ile Leu Glu Asp Ile Asn Leu Gln Val Thr Ser Gly Glu Val Val
            20                  25                  30

Ser Ile Leu Gly Pro Ser Gly Val Gly Lys Thr Thr Leu Phe Asn Leu
        35                  40                  45

Ile Ala Gly Ile Leu Glu Val Gln Ser Gly Arg Ile Val Leu Asp Gly
    50                  55                  60

Glu Glu Asn Pro Lys Gly Arg Val Ser Tyr Met Leu Gln Lys Asp Leu
65                  70                  75                  80

Leu Leu Glu His Lys Thr Val Leu Gly Asn Ile Ile Leu Pro Leu Leu
                85                  90                  95

Ile Gln Lys Val Asp Lys Ala Glu Ala Ile Ser Arg Ala Asp Lys Ile
            100                 105                 110

Leu Ala Thr Phe Gln Leu Thr Ala Val Arg Asp Lys Tyr Pro His Glu
        115                 120                 125

Leu Ser Gly Gly Met Arg Gln Arg Val Ala Leu Leu Arg Thr Tyr Leu
    130                 135                 140

Phe Gly His Lys Leu Phe Leu Leu Asp Glu Ala Phe Ser Ala Leu Asp
145                 150                 155                 160

Glu Met Thr Lys Met Glu Leu His Ala Trp Tyr Leu Glu Ile His Lys
                165                 170                 175

Gln Leu Gln Leu Thr Thr Leu Ile Ile Thr His Ser Ile Glu Glu Ala
            180                 185                 190

Leu Asn Leu Ser Asp Arg Ile Tyr Ile Leu Lys Asn Arg Pro Gly Gln
        195                 200                 205

Ile Val Ser Glu Ile Lys Leu Asp Trp Ser Glu Asp Glu Asp Lys Glu
    210                 215                 220

Val Gln Lys Ile Ala Tyr Lys Arg Gln Ile Leu Ala Glu Leu Gly Leu
225                 230                 235                 240

Asp Lys
```

<210> 73
<211> 2433
<212> DNA
<213> Streptococcus pneumoniae

<400> 73
atgaactatt caaaagcatt gaatgaatgt atcgaaagtg cctacatggt tgctggacat 60
tttggagctc gttatctaga gtcgtggcac ttgttgattg ccatgtctaa tcacagttat 120
agtgtagcag gggcaacttt aaatgattat ccgtatgaga tggaccgttt agaagaggtg 180

```
gctttggaac tgactgaaac ggactatagc caggatgaaa cctttacgga attgccgttc 240
tcccgtcgtt tgcaggttct ttttgatgaa gcagagtatg tagcgtcagt ggtccatgct 300
aaggtactag ggacagagca cgtcctctat gcgattttgc atgatagcaa tgccttggcg 360
actcgtatct tggagagggc tggtttttct tatgaagaca agaaagatca ggtcaagatt 420
gctgctcttc gtcgaaattt agaagaacgg gcaggctgga ctcgtgaaga tctcaaggct 480
ttacgccaac gccatcgtac agtagctgac aagcaaaatt ctatggccaa tatgatgggc 540
atgccgcaga ctcctagtgg tggtctcgag gattatacgc atgatttgac agagcaagcg 600
cgttctggca agttagaacc agtcatcggt cgggacaagg aaatctcacg tatgattcaa 660
atcttgagcc ggaagactaa gaacaaccct gtcttggttg gggatgctgg tgtcgggaaa 720
acagctctgg cgcttggtct tgcccagcgt attgctagtg gtgacgtgcc tgcggaaatg 780
gctaagatgc gcgtgttaga acttgatttg atgaatgtcg ttgcagggac acgcttccgt 840
ggtgactttg aagaacgcat gaataatatc atcaaggata ttgaagaaga tggccaagtc 900
atcctcttta tcgatgaact ccacaccatc atgggttctg gtagcgggat tgattcgact 960
ctggatgcgg ccaatatctt gaaaccagcc ttggcgcgtg gaactttgag aacggttggt 1020
gccactactc aggaagaata tcaaaaacat atcgaaaaag atgcggcact ttctcgtcgt 1080
ttcgctaaag tgacgattga agaaccaagt gtggcagata gtatgactat tttacaaggt 1140
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gcggttaaga tggctcatcg ttatttaacc agtcgtcact tgccagactc tgctatcgat 1260
ctcttggatg aggcggcagc aacagtgcaa aataaggcaa agcatgtaaa agcagacgat 1320
tcagatttga gtccagctga caaggccctg atggatggca agtggaaaca ggcagcccag 1380
ctaatcgcaa aagaagagga agtacctgtc tacaaagact tggtgacaga gtctgatatt 1440
ttgaccacct tgagtcgctt gtcaggaatc ccagttcaaa aactgactca aacggatgct 1500
aagaagtatt taaatcttga agcagaactc cataaacggg ttatcggtca agatcaagct 1560
gtttcaagca ttagccgtgc cattcgccgc aaccagtcag ggattcgcag tcataagcgt 1620
ccgattggtt cctttatgtt cctagggcct acaggtgtcg ggaaaactga attagccaag 1680
gctctggcag aagttctttt tgacgacgaa tcagccctta tccgctttga tatgagtgag 1740
tatatggaga aatttgcagc tagtcgtctc aacggagctc ctccaggcta tgtaggatat 1800
gaagaaggtg gggagttgac agagaaggtt cgcaataaac cctattccgt tctcctcttt 1860
gatgaggtag agaaggccca cccagatatc tttaatgttc tcttgcaggt tctggatgac 1920
ggtgtcttga cagatagcaa gggacgcaag gtcgattttt caaataccat tatcattatg 1980
acatcgaatc taggtgcgac tgcccttcgt gatgataaga ctgttggttt tggggctaag 2040
gatattcgtt ttgaccagga aaatatggaa aaacgcatgt ttgaagaact gaaaaaagct 2100
tatagaccgg aattcatcaa ccgtattgat gagaaggtgg tcttccatag cctatctagt 2160
gatcatatgc aggaagtggt gaagattatg gtcaagcctt tagtggcaag tttgactgaa 2220
aaaggcattg acttgaaatt acaagcttca gctctgaaat tgttagcaaa tcaaggatat 2280
gacccagaga tgggagctcg cccacttcgc agaaccctgc aaacagaagt ggaggacaag 2340
ttggcagaac ttcttctcaa gggagattta gtggcaggca gcacacttaa gattggtgtc 2400
aaagcaggcc agttaaaatt tgatattgca taa                              2433
```

<210> 74
<211> 810
<212> PRT
<213> Streptococcus pneumoniae

<400> 74

```
Met Asn Tyr Ser Lys Ala Leu Asn Glu Cys Ile Glu Ser Ala Tyr Met
  1               5                  10                  15

Val Ala Gly His Phe Gly Ala Arg Tyr Leu Glu Ser Trp His Leu Leu
             20                  25                  30

Ile Ala Met Ser Asn His Ser Tyr Ser Val Ala Gly Ala Thr Leu Asn
         35                  40                  45

Asp Tyr Pro Tyr Glu Met Asp Arg Leu Glu Glu Val Ala Leu Glu Leu
     50                  55                  60
```

```
Thr Glu Thr Asp Tyr Ser Gln Asp Glu Thr Phe Thr Glu Leu Pro Phe
 65                  70                  75                  80

Ser Arg Arg Leu Gln Val Leu Phe Asp Glu Ala Glu Tyr Val Ala Ser
                85                  90                  95

Val Val His Ala Lys Val Leu Gly Thr Glu His Val Leu Tyr Ala Ile
            100                 105                 110

Leu His Asp Ser Asn Ala Leu Ala Thr Arg Ile Leu Glu Arg Ala Gly
        115                 120                 125

Phe Ser Tyr Glu Asp Lys Lys Asp Gln Val Lys Ile Ala Ala Leu Arg
    130                 135                 140

Arg Asn Leu Glu Glu Arg Ala Gly Trp Thr Arg Glu Asp Leu Lys Ala
145                 150                 155                 160

Leu Arg Gln Arg His Arg Thr Val Ala Asp Lys Gln Asn Ser Met Ala
                165                 170                 175

Asn Met Met Gly Met Pro Gln Thr Pro Ser Gly Gly Leu Glu Asp Tyr
            180                 185                 190

Thr His Asp Leu Thr Glu Gln Ala Arg Ser Gly Lys Leu Glu Pro Val
        195                 200                 205

Ile Gly Arg Asp Lys Glu Ile Ser Arg Met Ile Gln Ile Leu Ser Arg
    210                 215                 220

Lys Thr Lys Asn Asn Pro Val Leu Val Gly Asp Ala Gly Val Gly Lys
225                 230                 235                 240

Thr Ala Leu Ala Leu Gly Leu Ala Gln Arg Ile Ala Ser Gly Asp Val
                245                 250                 255

Pro Ala Glu Met Ala Lys Met Arg Val Leu Glu Leu Asp Leu Met Asn
            260                 265                 270

Val Val Ala Gly Thr Arg Phe Arg Gly Asp Phe Glu Glu Arg Met Asn
        275                 280                 285

Asn Ile Ile Lys Asp Ile Glu Glu Asp Gly Gln Val Ile Leu Phe Ile
    290                 295                 300

Asp Glu Leu His Thr Ile Met Gly Ser Gly Ser Gly Ile Asp Ser Thr
305                 310                 315                 320

Leu Asp Ala Ala Asn Ile Leu Lys Pro Ala Leu Ala Arg Gly Thr Leu
                325                 330                 335

Arg Thr Val Gly Ala Thr Thr Gln Glu Glu Tyr Gln Lys His Ile Glu
            340                 345                 350

Lys Asp Ala Ala Leu Ser Arg Arg Phe Ala Lys Val Thr Ile Glu Glu
        355                 360                 365
```

```
Pro Ser Val Ala Asp Ser Met Thr Ile Leu Gln Gly Leu Lys Ala Thr
    370                 375                 380

Tyr Glu Lys His His Arg Val Gln Ile Thr Asp Glu Ala Val Glu Thr
385                 390                 395                 400

Ala Val Lys Met Ala His Arg Tyr Leu Thr Ser Arg His Leu Pro Asp
                405                 410                 415

Ser Ala Ile Asp Leu Leu Asp Glu Ala Ala Ala Thr Val Gln Asn Lys
            420                 425                 430

Ala Lys His Val Lys Ala Asp Asp Ser Asp Leu Ser Pro Ala Asp Lys
        435                 440                 445

Ala Leu Met Asp Gly Lys Trp Lys Gln Ala Ala Gln Leu Ile Ala Lys
    450                 455                 460

Glu Glu Glu Val Pro Val Tyr Lys Asp Leu Val Thr Glu Ser Asp Ile
465                 470                 475                 480

Leu Thr Thr Leu Ser Arg Leu Ser Gly Ile Pro Val Gln Lys Leu Thr
                485                 490                 495

Gln Thr Asp Ala Lys Lys Tyr Leu Asn Leu Glu Ala Glu Leu His Lys
            500                 505                 510

Arg Val Ile Gly Gln Asp Gln Ala Val Ser Ser Ile Ser Arg Ala Ile
        515                 520                 525

Arg Arg Asn Gln Ser Gly Ile Arg Ser His Lys Arg Pro Ile Gly Ser
    530                 535                 540

Phe Met Phe Leu Gly Pro Thr Gly Val Gly Lys Thr Glu Leu Ala Lys
545                 550                 555                 560

Ala Leu Ala Glu Val Leu Phe Asp Asp Glu Ser Ala Leu Ile Arg Phe
                565                 570                 575

Asp Met Ser Glu Tyr Met Glu Lys Phe Ala Ala Ser Arg Leu Asn Gly
            580                 585                 590

Ala Pro Pro Gly Tyr Val Gly Tyr Glu Glu Gly Gly Glu Leu Thr Glu
        595                 600                 605

Lys Val Arg Asn Lys Pro Tyr Ser Val Leu Leu Phe Asp Glu Val Glu
    610                 615                 620

Lys Ala His Pro Asp Ile Phe Asn Val Leu Leu Gln Val Leu Asp Asp
625                 630                 635                 640

Gly Val Leu Thr Asp Ser Lys Gly Arg Lys Val Asp Phe Ser Asn Thr
                645                 650                 655

Ile Ile Ile Met Thr Ser Asn Leu Gly Ala Thr Ala Leu Arg Asp Asp
            660                 665                 670
```

```
Lys Thr Val Gly Phe Gly Ala Lys Asp Ile Arg Phe Asp Gln Glu Asn
        675                 680                 685

Met Glu Lys Arg Met Phe Glu Glu Leu Lys Lys Ala Tyr Arg Pro Glu
    690                 695                 700

Phe Ile Asn Arg Ile Asp Glu Lys Val Val Phe His Ser Leu Ser Ser
705                 710                 715                 720

Asp His Met Gln Glu Val Val Lys Ile Met Val Lys Pro Leu Val Ala
                725                 730                 735

Ser Leu Thr Glu Lys Gly Ile Asp Leu Lys Leu Gln Ala Ser Ala Leu
            740                 745                 750

Lys Leu Leu Ala Asn Gln Gly Tyr Asp Pro Glu Met Gly Ala Arg Pro
        755                 760                 765

Leu Arg Arg Thr Leu Gln Thr Glu Val Glu Asp Lys Leu Ala Glu Leu
    770                 775                 780

Leu Leu Lys Gly Asp Leu Val Ala Gly Ser Thr Leu Lys Ile Gly Val
785                 790                 795                 800

Lys Ala Gly Gln Leu Lys Phe Asp Ile Ala
                805                 810
```

<210> 75
<211> 1008
<212> DNA
<213> Streptococcus pneumoniae

<400> 75
```
atgaagaaaa catggaaagt gtttttaacg cttgtaacag ctcttgtagc tgttgtgctt 60
gtggcctgtg gtcaaggaac tgcttctaaa gacaacaaag aggcagaact taagaaggtt 120
gactttatcc tagactggac accaaatacc aaccacacag ggctttatgt tgccaaggaa 180
aaaggttatt tcaaagaagc tggagtggat gttgatttga aattgccacc agaagaaagt 240
tcttctgact tggttatcaa cggaaaggca ccatttgcag tgtatttcca agactacatg 300
gctaagaaat tggaaaaagg agcaggaatc actgccgttg cagctattgt tgaacacaat 360
acatcaggaa tcatctctcg taaatctgat aatgtaagca gtccaaaaga cttggttggt 420
aagaaatatg ggacatggaa tgacccaact gaacttgcta tgttgaaaac cttggtagaa 480
tctcaaggtg gagactttga gaaggttgaa aaagtaccaa ataacgactc aaactcaatc 540
acaccgattg ccaatggcgt ctttgatact gcttggattt actacggttg ggatggtatc 600
cttgctaaat ctcaaggtgt agatgctaac ttcatgtact tgaaagacta tgtcaaggag 660
tttgactact attcaccagt tatcatcgca aacaacgact atctgaaaga taacaaagaa 720
gaagctcgca aagtcatcca agccatcaaa aaaggctacc aatatgccat ggaacatcca 780
gaagaagctg cagatattct catcaagaat gcacctgaac tcaaggaaaa acgtgacttt 840
gtcatcgaat ctcaaaaata cttgtcaaaa gaatacgcaa gcgacaagga aaaatggggt 900
caatttgacg cagctcgctg gaatgctttc tacaaatggg ataaagaaaa tggtatcctt 960
aaagaagact tgacagacaa aggcttcacc aacgaatttg tgaaataa              1008
```

<210> 76
<211> 335

<212> PRT
<213> Streptococcus pneumoniae

<400> 76

```
Met Lys Lys Thr Trp Lys Val Phe Leu Thr Leu Val Thr Ala Leu Val
  1               5                  10                  15

Ala Val Val Leu Val Ala Cys Gly Gln Gly Thr Ala Ser Lys Asp Asn
             20                  25                  30

Lys Glu Ala Glu Leu Lys Lys Val Asp Phe Ile Leu Asp Trp Thr Pro
         35                  40                  45

Asn Thr Asn His Thr Gly Leu Tyr Val Ala Lys Glu Lys Gly Tyr Phe
     50                  55                  60

Lys Glu Ala Gly Val Asp Val Asp Leu Lys Leu Pro Pro Glu Glu Ser
 65                  70                  75                  80

Ser Ser Asp Leu Val Ile Asn Gly Lys Ala Pro Phe Ala Val Tyr Phe
                 85                  90                  95

Gln Asp Tyr Met Ala Lys Lys Leu Glu Lys Gly Ala Gly Ile Thr Ala
            100                 105                 110

Val Ala Ala Ile Val Glu His Asn Thr Ser Gly Ile Ile Ser Arg Lys
        115                 120                 125

Ser Asp Asn Val Ser Ser Pro Lys Asp Leu Val Gly Lys Lys Tyr Gly
    130                 135                 140

Thr Trp Asn Asp Pro Thr Glu Leu Ala Met Leu Lys Thr Leu Val Glu
145                 150                 155                 160

Ser Gln Gly Gly Asp Phe Glu Lys Val Glu Lys Val Pro Asn Asn Asp
                165                 170                 175

Ser Asn Ser Ile Thr Pro Ile Ala Asn Gly Val Phe Asp Thr Ala Trp
            180                 185                 190

Ile Tyr Tyr Gly Trp Asp Gly Ile Leu Ala Lys Ser Gln Gly Val Asp
        195                 200                 205

Ala Asn Phe Met Tyr Leu Lys Asp Tyr Val Lys Glu Phe Asp Tyr Tyr
    210                 215                 220

Ser Pro Val Ile Ile Ala Asn Asn Asp Tyr Leu Lys Asp Asn Lys Glu
225                 230                 235                 240

Glu Ala Arg Lys Val Ile Gln Ala Ile Lys Lys Gly Tyr Gln Tyr Ala
                245                 250                 255

Met Glu His Pro Glu Glu Ala Ala Asp Ile Leu Ile Lys Asn Ala Pro
            260                 265                 270

Glu Leu Lys Glu Lys Arg Asp Phe Val Ile Glu Ser Gln Lys Tyr Leu
        275                 280                 285
```

```
Ser Lys Glu Tyr Ala Ser Asp Lys Glu Lys Trp Gly Gln Phe Asp Ala
    290                 295                 300

Ala Arg Trp Asn Ala Phe Tyr Lys Trp Asp Lys Glu Asn Gly Ile Leu
305                 310                 315                 320

Lys Glu Asp Leu Thr Asp Lys Gly Phe Thr Asn Glu Phe Val Lys
                325                 330                 335
```

<210> 77
<211> 762
<212> DNA
<213> Streptococcus pneumoniae

<400> 77
ttgatgagaa acttgagaag tatactgaga cgacacatta gtctattggg ctttctcgga 60
gtattgtcaa tctggcagtt agcaggtttt cttaaacttc tccccaagtt tatcctgccg 120
acacctcttg aaattctcca gccctttgtt cgtgacagag aatttctctg gcaccatagc 180
tgggcgacct tgagagtggc tttactgggg ctgattttgg gagttttgat tgcctgtctt 240
atggctgtgc tcatggatag tttgacttgg ctcaatgacc tgatttaccc tatgatggtg 300
gtcattcaga ccattccgac cattgccata gctcctatcc tggtcttgtg gctaggttat 360
gggattttgc ccaagattgt cttgattatc ttaacgacaa cctttcccat catcgttagt 420
attttggacg gttttaggca ttgcgacaag gatatgctga ccttgtttag tctgatgcgg 480
gccaagcctt ggcaaatcct gtggcatttt aaaatcccag ttagcctgcc ttacttttat 540
gcaggtctga gggtcagtgt ctcctacgcc tttatcacaa ctgtggtatc tgagtggttg 600
ggaggttttg aaggtcttgg tgtttatatg attcagtcta aaaaactgtt tcagtatgat 660
accatgtttg ccattattat tctggtgtcg attatcagtc ttttgggtat gaagctggtc 720
gatatcagtg aaaaatatgt gattaaatgg aaacgttcgt ag   762

<210> 78
<211> 253
<212> PRT
<213> Streptococcus pneumoniae

<400> 78
```
Met Met Arg Asn Leu Arg Ser Ile Leu Arg Arg His Ile Ser Leu Leu
  1               5                  10                  15

Gly Phe Leu Gly Val Leu Ser Ile Trp Gln Leu Ala Gly Phe Leu Lys
            20                  25                  30

Leu Leu Pro Lys Phe Ile Leu Pro Thr Pro Leu Glu Ile Leu Gln Pro
        35                  40                  45

Phe Val Arg Asp Arg Glu Phe Leu Trp His His Ser Trp Ala Thr Leu
    50                  55                  60

Arg Val Ala Leu Leu Gly Leu Ile Leu Gly Val Leu Ile Ala Cys Leu
65                  70                  75                  80

Met Ala Val Leu Met Asp Ser Leu Thr Trp Leu Asn Asp Leu Ile Tyr
                85                  90                  95
```

```
Pro Met Met Val Val Ile Gln Thr Ile Pro Thr Ile Ala Ile Ala Pro
            100                 105                 110

Ile Leu Val Leu Trp Leu Gly Tyr Gly Ile Leu Pro Lys Ile Val Leu
        115                 120                 125

Ile Ile Leu Thr Thr Thr Phe Pro Ile Ile Val Ser Ile Leu Asp Gly
    130                 135                 140

Phe Arg His Cys Asp Lys Asp Met Leu Thr Leu Phe Ser Leu Met Arg
145                 150                 155                 160

Ala Lys Pro Trp Gln Ile Leu Trp His Phe Lys Ile Pro Val Ser Leu
                165                 170                 175

Pro Tyr Phe Tyr Ala Gly Leu Arg Val Ser Val Ser Tyr Ala Phe Ile
            180                 185                 190

Thr Thr Val Val Ser Glu Trp Leu Gly Gly Phe Glu Gly Leu Gly Val
        195                 200                 205

Tyr Met Ile Gln Ser Lys Lys Leu Phe Gln Tyr Asp Thr Met Phe Ala
    210                 215                 220

Ile Ile Ile Leu Val Ser Ile Ile Ser Leu Leu Gly Met Lys Leu Val
225                 230                 235                 240

Asp Ile Ser Glu Lys Tyr Val Ile Lys Trp Lys Arg Ser
                245                 250
```

<210> 79
<211> 372
<212> DNA
<213> Streptococcus pneumoniae

<400> 79
ttgattttta atcctatttg ctgtatgata agggaaaaga aaggggacag agatatggct 60
tttaccaata cccacatgcg atctgctagt tttggtattg ttaccagctt gcctgatgac 120
atcattgact ctttttggta tatcatcgac catttcttaa aaaatgtctt tgaattggaa 180
gaagaactcg agtttcaatt gcttaataac caaggaaaga ttaccttcca cttttcaagt 240
caacacctcc ctacagccat tgattttgac tttaaccatc ctttcgaccc tcgttatccc 300
ccaagagtac tggttttaga catggacggt agagaaacta tcctcctccc agaagaaaat 360
gacctatttt aa 372

<210> 80
<211> 123
<212> PRT
<213> Streptococcus pneumoniae

<400> 80
```
Met Ile Phe Asn Pro Ile Cys Cys Met Ile Arg Glu Lys Lys Gly Asp
  1               5                  10                  15

Arg Asp Met Ala Phe Thr Asn Thr His Met Arg Ser Ala Ser Phe Gly
```

```
            20                  25                  30

Ile Val Thr Ser Leu Pro Asp Asp Ile Ile Asp Ser Phe Trp Tyr Ile
         35                  40                  45

Ile Asp His Phe Leu Lys Asn Val Phe Glu Leu Glu Glu Glu Leu Glu
     50                  55                  60

Phe Gln Leu Leu Asn Asn Gln Gly Lys Ile Thr Phe His Phe Ser Ser
 65                  70                  75                  80

Gln His Leu Pro Thr Ala Ile Asp Phe Asp Phe Asn His Pro Phe Asp
                 85                  90                  95

Pro Arg Tyr Pro Pro Arg Val Leu Val Leu Asp Met Asp Gly Arg Glu
            100                 105                 110

Thr Ile Leu Leu Pro Glu Glu Asn Asp Leu Phe
        115                 120
```

<210> 81
<211> 1645
<212> DNA
<213> Streptococcus pneumoniae

<400> 81

```
acagcggtgt cattctatct attttaagaa aagtaataat caattgttaa aaatagtaaa 60
aaaattggag gttctgatga aatattttgt tcctaatgag gtattcagta ttcgtaaatt 120
aaaggtgggg acttgctcgg tactattggc aatttcaatt ttgggaagcc aaggtatttt 180
atcggatgaa gttgttacta gttcttcacc gatggctaca aaagagtctt ctaatgcaat 240
tactaatgat ttagataatt caccaactgt taatcagaat cgttctgctg aaatgattgc 300
ctctaattca accactaatg gtttagataa ttcgttaagt gttaatagca tcagctctaa 360
tggtactatt cgttccaatt cacaattaga caacagaaca gttgaatcta cagtaacatc 420
tactaatgaa aataagagtt ataaggaaga tgttataagt gacagaatta tcaaaaaaga 480
atttgaagat actgctttaa gtgtaaaaga ttatggtgca gtaggtgatg ggattcatga 540
tgatcgacaa gcaattcaag atgcaataga tgctgcagct caagggctag gtggaggaaa 600
tgtatatttt cctgaaggaa cttatttagt aaaagaaatt gttttttaa aaagtcatac 660
acacttagaa ttgaatgaga aagctacaat tctaaatggt ataaatatta agaatcaccc 720
ttccattgtt tttatgacag gtttatttac ggatgatggt gcgcaagtag aatggggccc 780
aacagaagat attagttatt ctggtggtac gattgatatg aacggtgctt tgaatgaaga 840
aggaactaaa gcaaaaaatc taccacttat aaattcttca ggtgcatttg ctattgggaa 900
ttcaaataac gtaactataa aaaatgtaac attcaaggat agttatcaag ggcatgctat 960
tcaaattgca ggttcgaaaa atgtattagt tgataattct cgttttcttg ggcaagcctt 1020
acccaaaacg atgaaggatg ggcaaatcat aagtaaggag agcattcaga ttgaaccatt 1080
aactagaaaa ggttttcctt atgccttgaa tgatgatggg aaaaaatctg aaaatgtgac 1140
tattcaaaat tcctattttg gcaaaagtga taaatctggg gaattagtaa cagcaattgg 1200
cacacactat caaacattgt cgacacagaa cccctctaat attaaaattc aaaataatca 1260
ttttgataac atgatgtatg caggtgtacg ttttacagga ttcactgatg tattaatcaa 1320
aggaaatcgc tttgataaga aagttaaagg agagagtgta cattatcgag aaagcggagc 1380
agctttagta aatgcttata gctataaaaa cactaaagac ctattagatt taaataaaca 1440
ggtggttatc gccgaaaata tatttaatat tgccgatcct aaaacaaaag cgatacgagt 1500
tgcaaaagat agtgcagaat gtttaggaaa agtatcagat attactgtaa caaaaaatgt 1560
aattaataat aattctaagg aaacagaaca accaaatatt gaattattac gagttagtga 1620
taatttagta gtctcagaga atagt                                      1645
```

<210> 82
<211> 548
<212> PRT
<213> Streptococcus pneumoniae

<400> 82
Gln Arg Cys His Ser Ile Tyr Phe Lys Lys Ser Asn Asn Gln Leu Leu
1 5 10 15

Lys Ile Val Lys Lys Leu Glu Val Leu Met Lys Tyr Phe Val Pro Asn
20 25 30

Glu Val Phe Ser Ile Arg Lys Leu Lys Val Gly Thr Cys Ser Val Leu
35 40 45

Leu Ala Ile Ser Ile Leu Gly Ser Gln Gly Ile Leu Ser Asp Glu Val
50 55 60

Val Thr Ser Ser Ser Pro Met Ala Thr Lys Glu Ser Ser Asn Ala Ile
65 70 75 80

Thr Asn Asp Leu Asp Asn Ser Pro Thr Val Asn Gln Asn Arg Ser Ala
85 90 95

Glu Met Ile Ala Ser Asn Ser Thr Thr Asn Gly Leu Asp Asn Ser Leu
100 105 110

Ser Val Asn Ser Ile Ser Ser Asn Gly Thr Ile Arg Ser Asn Ser Gln
115 120 125

Leu Asp Asn Arg Thr Val Glu Ser Thr Val Thr Ser Thr Asn Glu Asn
130 135 140

Lys Ser Tyr Lys Glu Asp Val Ile Ser Asp Arg Ile Ile Lys Lys Glu
145 150 155 160

Phe Glu Asp Thr Ala Leu Ser Val Lys Asp Tyr Gly Ala Val Gly Asp
165 170 175

Gly Ile His Asp Asp Arg Gln Ala Ile Gln Asp Ala Ile Asp Ala Ala
180 185 190

Ala Gln Gly Leu Gly Gly Gly Asn Val Tyr Phe Pro Glu Gly Thr Tyr
195 200 205

Leu Val Lys Glu Ile Val Phe Leu Lys Ser His Thr His Leu Glu Leu
210 215 220

Asn Glu Lys Ala Thr Ile Leu Asn Gly Ile Asn Ile Lys Asn His Pro
225 230 235 240

Ser Ile Val Phe Met Thr Gly Leu Phe Thr Asp Asp Gly Ala Gln Val
245 250 255

Glu Trp Gly Pro Thr Glu Asp Ile Ser Tyr Ser Gly Gly Thr Ile Asp
260 265 270

```
Met Asn Gly Ala Leu Asn Glu Glu Gly Thr Lys Ala Lys Asn Leu Pro
        275                 280                 285

Leu Ile Asn Ser Ser Gly Ala Phe Ala Ile Gly Asn Ser Asn Asn Val
    290                 295                 300

Thr Ile Lys Asn Val Thr Phe Lys Asp Ser Tyr Gln Gly His Ala Ile
305                 310                 315                 320

Gln Ile Ala Gly Ser Lys Asn Val Leu Val Asp Asn Ser Arg Phe Leu
                325                 330                 335

Gly Gln Ala Leu Pro Lys Thr Met Lys Asp Gly Gln Ile Ile Ser Lys
            340                 345                 350

Glu Ser Ile Gln Ile Glu Pro Leu Thr Arg Lys Gly Phe Pro Tyr Ala
        355                 360                 365

Leu Asn Asp Asp Gly Lys Lys Ser Glu Asn Val Thr Ile Gln Asn Ser
    370                 375                 380

Tyr Phe Gly Lys Ser Asp Lys Ser Gly Glu Leu Val Thr Ala Ile Gly
385                 390                 395                 400

Thr His Tyr Gln Thr Leu Ser Thr Gln Asn Pro Ser Asn Ile Lys Ile
                405                 410                 415

Gln Asn Asn His Phe Asp Asn Met Met Tyr Ala Gly Val Arg Phe Thr
            420                 425                 430

Gly Phe Thr Asp Val Leu Ile Lys Gly Asn Arg Phe Asp Lys Lys Val
        435                 440                 445

Lys Gly Glu Ser Val His Tyr Arg Glu Ser Gly Ala Ala Leu Val Asn
    450                 455                 460

Ala Tyr Ser Tyr Lys Asn Thr Lys Asp Leu Leu Asp Leu Asn Lys Gln
465                 470                 475                 480

Val Val Ile Ala Glu Asn Ile Phe Asn Ile Ala Asp Pro Lys Thr Lys
                485                 490                 495

Ala Ile Arg Val Ala Lys Asp Ser Ala Glu Cys Leu Gly Lys Val Ser
            500                 505                 510

Asp Ile Thr Val Thr Lys Asn Val Ile Asn Asn Asn Ser Lys Glu Thr
        515                 520                 525

Glu Gln Pro Asn Ile Glu Leu Leu Arg Val Ser Asp Asn Leu Val Val
    530                 535                 540

Ser Glu Asn Ser
545
```

<210> 83
<211> 324
<212> DNA
<213> Streptococcus pneumoniae

<400> 83
gtgatgaaag aaactcagct attaaaaggt gttcttgaag gttgtgtctt ggatatgatt 60
ggtcaaaaag agcggtatgg ttatgagttg gttcagactt tgcgagaggc tggatttgat 120
actatcgttc caggaactat ttatcctttg ttgcaaaagt tagaaaaaaa tcaatggata 180
agaggcgaca tgcgcccgtc gccagatggt ccagatcgga agtatttttc attaatgaaa 240
gaaggagaag agcgtgtctc agtcttttgg caacaatggg acgatttgag tcaaaaagta 300
gaagggatta agaatggggg ttaa 324

<210> 84
<211> 107
<212> PRT
<213> Streptococcus pneumoniae

<400> 84
Met Met Lys Glu Thr Gln Leu Leu Lys Gly Val Leu Glu Gly Cys Val
1 5 10 15

Leu Asp Met Ile Gly Gln Lys Glu Arg Tyr Gly Tyr Glu Leu Val Gln
20 25 30

Thr Leu Arg Glu Ala Gly Phe Asp Thr Ile Val Pro Gly Thr Ile Tyr
35 40 45

Pro Leu Leu Gln Lys Leu Glu Lys Asn Gln Trp Ile Arg Gly Asp Met
50 55 60

Arg Pro Ser Pro Asp Gly Pro Asp Arg Lys Tyr Phe Ser Leu Met Lys
65 70 75 80

Glu Gly Glu Glu Arg Val Ser Val Phe Trp Gln Gln Trp Asp Asp Leu
85 90 95

Ser Gln Lys Val Glu Gly Ile Lys Asn Gly Gly
100 105

<210> 85
<211> 816
<212> DNA
<213> Streptococcus pneumoniae

<400> 85
atgaagaaaa tgaagtatta cgaagaaaca agcgctttgc tacatgagtt ttctgaggag 60
aatcaaaagt attttgagga gttgtgggaa agttttaatc ttgctggatt tctctatgat 120
gaagactatc tcagagagca gatctatttg atgatgctag atttctcaga agcagaacga 180
gatggcatga gtgcagagga ttatctaggt aagaatccta aaaaaataat gaaagagatt 240
ctcaagggag cacctcgcag ttctatcaaa gagtcccttt tgacgccaat tcttgtcctg 300
gcggtattac gttattatca actactaagt gatttttcta aaggtcctct cttaacagtc 360
aatttgctca catttttagg gcaacttctt atttttctga ttggatttgg acttgtggcc 420
acaattttac gaagaagttt agtccaagat tctcctaaaa tgaaaattgg cacttacatt 480

gttgttggga ctatagttct tctagttgtt ttaggatatg taggaatggc aagcttcata 540
caagaaggag ccttttatat tccggctccc tgggatagtt tgtctgtctt tacgatttcg 600
ctagttatcg gtatttggaa ttggaaagaa gcggtctttc gtccatttgt cagtatgatt 660
attgcccatc ttgtggtggg ttctctgctc cgttattatg agtggatggg aatttcaaat 720
gttttcctta caaaagttat tcctttagct gtcctcttta ttggaatctt tgtcttgttc 780
cgtgggttta agaagataaa atggagtgaa gtatag 816

<210> 86
<211> 271
<212> PRT
<213> Streptococcus pneumoniae

<400> 86
Met Lys Lys Met Lys Tyr Tyr Glu Glu Thr Ser Ala Leu Leu His Glu
1 5 10 15

Phe Ser Glu Glu Asn Gln Lys Tyr Phe Glu Glu Leu Trp Glu Ser Phe
20 25 30

Asn Leu Ala Gly Phe Leu Tyr Asp Glu Asp Tyr Leu Arg Glu Gln Ile
35 40 45

Tyr Leu Met Met Leu Asp Phe Ser Glu Ala Glu Arg Asp Gly Met Ser
50 55 60

Ala Glu Asp Tyr Leu Gly Lys Asn Pro Lys Lys Ile Met Lys Glu Ile
65 70 75 80

Leu Lys Gly Ala Pro Arg Ser Ser Ile Lys Glu Ser Leu Leu Thr Pro
85 90 95

Ile Leu Val Leu Ala Val Leu Arg Tyr Tyr Gln Leu Leu Ser Asp Phe
100 105 110

Ser Lys Gly Pro Leu Leu Thr Val Asn Leu Leu Thr Phe Leu Gly Gln
115 120 125

Leu Leu Ile Phe Leu Ile Gly Phe Gly Leu Val Ala Thr Ile Leu Arg
130 135 140

Arg Ser Leu Val Gln Asp Ser Pro Lys Met Lys Ile Gly Thr Tyr Ile
145 150 155 160

Val Val Gly Thr Ile Val Leu Leu Val Val Leu Gly Tyr Val Gly Met
165 170 175

Ala Ser Phe Ile Gln Glu Gly Ala Phe Tyr Ile Pro Ala Pro Trp Asp
180 185 190

Ser Leu Ser Val Phe Thr Ile Ser Leu Val Ile Gly Ile Trp Asn Trp
195 200 205

Lys Glu Ala Val Phe Arg Pro Phe Val Ser Met Ile Ile Ala His Leu
210 215 220

Val Val Gly Ser Leu Leu Arg Tyr Tyr Glu Trp Met Gly Ile Ser Asn

```
225                 230                 235                 240

Val Phe Leu Thr Lys Val Ile Pro Leu Ala Val Leu Phe Ile Gly Ile
                245                 250                 255

Phe Val Leu Phe Arg Gly Phe Lys Lys Ile Lys Trp Ser Glu Val
            260                 265                 270
```

<210> 87
<211> 348
<212> DNA
<213> Streptococcus pneumoniae

<400> 87
ctgttttttt atttatactc aatgaaaatc aaagagcaaa ctaggaagct agccgcaggt 60
tgctcaaaac actgttttga ggttgtagac gaaactgacg aagtcagctc aaaacatgtt 120
tttgaggttg tagatgaaac tgacgaagtc agctcaaaac actgttttga ggttgtagat 180
gaaactgacg aagtcagctc aaaacactgt tttgaggttg tagatgaaac tgacgaagtc 240
agctcaaaac atgtttttga ggttgtagat gaaactgacg aagtcagtaa ccatacatac 300
ggtagggcga cgctgacgtg gtttgaagag attttcgaag agtattaa 348

<210> 88
<211> 115
<212> PRT
<213> Streptococcus pneumoniae

<400> 88
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Met Phe Phe Tyr Leu Tyr Ser Met Lys Ile Lys Glu Gln Thr Arg Lys
  1               5                  10                  15

Leu Ala Ala Gly Cys Ser Lys His Cys Phe Glu Val Val Asp Glu Thr
             20                  25                  30

Asp Glu Val Ser Ser Lys His Val Phe Glu Val Val Asp Glu Thr Asp
         35                  40                  45

Glu Val Ser Ser Lys His Cys Phe Glu Val Val Asp Glu Thr Asp Glu
     50                  55                  60

Val Ser Ser Lys His Cys Phe Glu Val Val Asp Glu Thr Asp Glu Val
 65                  70                  75                  80

Ser Ser Lys His Val Phe Glu Val Val Asp Glu Thr Asp Glu Val Ser
                85                  90                  95

Asn His Thr Tyr Gly Arg Ala Thr Leu Thr Trp Phe Glu Glu Ile Phe
            100                 105                 110

Glu Glu Tyr
        115
```

<210> 89

<211> 1260
<212> DNA
<213> Streptococcus pneumoniae

<400> 89
atgcagaatc tgaaatttgc cttttcatct atcatggctc acaagatgcg ttctttgctt 60
actatgattg ggattattat cggtgtttca tcagttgttg tgattatggc tttgggtgat 120
tccctatctc gtcaagtcaa taaagatatg actaaatctc agaaaaatat tagcgtcttt 180
ttctctccta aaaaaagtaa agacgggtct tttactcaga aacaatcagc ttttacggtt 240
tctggaaagg aagaggaagt tcctgttgaa ccgccaaaac cgcaagaatc ctgggtccaa 300
gaggcagcta aactgaaggg agtggatagt tactatgtaa ccaattcaac gaatgccatc 360
ttgacctatc aagataaaaa ggttgagaat gctaatttga caggtggaaa cagaacttac 420
atggacgctg ttaagaatga aattattgca ggtcgtagtc tgagagagca agatttcaaa 480
gagtttgcaa gtgtcatttt gctagatgag gaattgtcca ttagtttatt tgaatctcct 540
caagaggcta ttaacaaggt tgtagaagtc aatggattta gttaccgggt cattggggtt 600
tatactagtc cggaggctaa aagatcaaaa atatatgggt ttggtggctt gcctattact 660
accaatatct cccttgctgc gaattttaat gtagatgaaa tagctaatat tgtctttcga 720
gtgaatgata ccagtttaac cccaactctg ggtccagaac tggcacgaaa aatgacagag 780
cttgcaggct tacaacaggg agaataccag gtggcagatg agtccgttgt atttgcagaa 840
attcaacaat cgtttagttt tatgacgacg attattagtt ccatcgcagg gatttctctc 900
tttgttggag gaactggtgt catgaacatc atgctggttt cggtgacaga gcgcactcgt 960
gagattggtc ttcgtaaggc tttgggtgca acacgtgcca atattttaat tcagtttttg 1020
attgaatcca tgattttgac cttgttaggt ggcttaattg gcttgacaat tgcaagtggt 1080
ttaactgcct tagcaggttt gttactgcaa ggtttaatag aaggtataga agttggagta 1140
tcaatcccag tcgccctatt tagtcttgca gtttcggcta gtgttggtat gatttttgga 1200
gtcttgccag ccaacaaggc atcgaaactt gatccaattg aagcccttcg ttatgaatga 1260

<210> 90
<211> 419
<212> PRT
<213> Streptococcus pneumoniae

<400> 90
Met Gln Asn Leu Lys Phe Ala Phe Ser Ser Ile Met Ala His Lys Met
  1   5   10   15

Arg Ser Leu Leu Thr Met Ile Gly Ile Ile Ile Gly Val Ser Ser Val
             20   25   30

Val Val Ile Met Ala Leu Gly Asp Ser Leu Ser Arg Gln Val Asn Lys
         35   40   45

Asp Met Thr Lys Ser Gln Lys Asn Ile Ser Val Phe Phe Ser Pro Lys
     50   55   60

Lys Ser Lys Asp Gly Ser Phe Thr Gln Lys Gln Ser Ala Phe Thr Val
 65   70   75   80

Ser Gly Lys Glu Glu Glu Val Pro Val Glu Pro Pro Lys Pro Gln Glu
                 85   90   95

Ser Trp Val Gln Glu Ala Ala Lys Leu Lys Gly Val Asp Ser Tyr Tyr
            100   105   110

Val Thr Asn Ser Thr Asn Ala Ile Leu Thr Tyr Gln Asp Lys Lys Val
        115   120   125

```
Glu Asn Ala Asn Leu Thr Gly Gly Asn Arg Thr Tyr Met Asp Ala Val
    130                 135                 140

Lys Asn Glu Ile Ile Ala Gly Arg Ser Leu Arg Glu Gln Asp Phe Lys
145                 150                 155                 160

Glu Phe Ala Ser Val Ile Leu Leu Asp Glu Glu Leu Ser Ile Ser Leu
                165                 170                 175

Phe Glu Ser Pro Gln Glu Ala Ile Asn Lys Val Val Glu Val Asn Gly
            180                 185                 190

Phe Ser Tyr Arg Val Ile Gly Val Tyr Thr Ser Pro Glu Ala Lys Arg
        195                 200                 205

Ser Lys Ile Tyr Gly Phe Gly Gly Leu Pro Ile Thr Thr Asn Ile Ser
    210                 215                 220

Leu Ala Ala Asn Phe Asn Val Asp Glu Ile Ala Asn Ile Val Phe Arg
225                 230                 235                 240

Val Asn Asp Thr Ser Leu Thr Pro Thr Leu Gly Pro Glu Leu Ala Arg
                245                 250                 255

Lys Met Thr Glu Leu Ala Gly Leu Gln Gln Gly Glu Tyr Gln Val Ala
            260                 265                 270

Asp Glu Ser Val Val Phe Ala Glu Ile Gln Gln Ser Phe Ser Phe Met
        275                 280                 285

Thr Thr Ile Ile Ser Ser Ile Ala Gly Ile Ser Leu Phe Val Gly Gly
    290                 295                 300

Thr Gly Val Met Asn Ile Met Leu Val Ser Val Thr Glu Arg Thr Arg
305                 310                 315                 320

Glu Ile Gly Leu Arg Lys Ala Leu Gly Ala Thr Arg Ala Asn Ile Leu
                325                 330                 335

Ile Gln Phe Leu Ile Glu Ser Met Ile Leu Thr Leu Leu Gly Gly Leu
            340                 345                 350

Ile Gly Leu Thr Ile Ala Ser Gly Leu Thr Ala Leu Ala Gly Leu Leu
        355                 360                 365

Leu Gln Gly Leu Ile Glu Gly Ile Glu Val Gly Val Ser Ile Pro Val
    370                 375                 380

Ala Leu Phe Ser Leu Ala Val Ser Ala Ser Val Gly Met Ile Phe Gly
385                 390                 395                 400

Val Leu Pro Ala Asn Lys Ala Ser Lys Leu Asp Pro Ile Glu Ala Leu
                405                 410                 415

Arg Tyr Glu
```

<210> 91
<211> 705
<212> DNA
<213> Streptococcus pneumoniae

<400> 91
ctgatgaagc aactaattag tctaaaaaat atcttcagaa gttaccgtaa tggtgaccaa 60
gaactgcagg ttctcaaaaa tatcaatcta gaagtgaatg agggtgaatt tgtagccatc 120
atgggaccat ctgggtctgg taagtccact ctgatgaata cgattggcat gttggataca 180
ccaaccagtg gagaatatta tcttgaaggt caagaagtgg ctgggcttgg tgaaaaacaa 240
ctagctaagg tccgtaacca acaaatcggt tttgtctttc agcagttctt tcttctatcg 300
aagctcaatg ctctgcaaaa tgtagaattg cccttgattt acgcaggagt ttcgtcttca 360
aaacgtcgca agttggctga ggaatattta gacaaggttg aattgacaga acgtagtcac 420
catttacctt cagaattatc tggtggtcaa aagcaacgtg tagccattgc gcgtgccttg 480
gtaaacaatc cttctattat cctagcggat gaaccgacag gagccttgga taccaaaaca 540
ggtaaccaaa ttatgcaatt attggttgat ttgaataaag aaggaaaaac cattatcatg 600
gtaacgcatg agcctgagat tgctgcctat gccaaacgtc agattgtcat tcgggatggg 660
gtcatttcgt ctgacagtgc tcagttagga aaggaggaaa actaa 705

<210> 92
<211> 234
<212> PRT
<213> Streptococcus pneumoniae

<400> 92
Met Met Lys Gln Leu Ile Ser Leu Lys Asn Ile Phe Arg Ser Tyr Arg
1 5 10 15

Asn Gly Asp Gln Glu Leu Gln Val Leu Lys Asn Ile Asn Leu Glu Val
20 25 30

Asn Glu Gly Glu Phe Val Ala Ile Met Gly Pro Ser Gly Ser Gly Lys
35 40 45

Ser Thr Leu Met Asn Thr Ile Gly Met Leu Asp Thr Pro Thr Ser Gly
50 55 60

Glu Tyr Tyr Leu Glu Gly Gln Glu Val Ala Gly Leu Gly Glu Lys Gln
65 70 75 80

Leu Ala Lys Val Arg Asn Gln Gln Ile Gly Phe Val Phe Gln Gln Phe
85 90 95

Phe Leu Leu Ser Lys Leu Asn Ala Leu Gln Asn Val Glu Leu Pro Leu
100 105 110

Ile Tyr Ala Gly Val Ser Ser Ser Lys Arg Arg Lys Leu Ala Glu Glu
115 120 125

Tyr Leu Asp Lys Val Glu Leu Thr Glu Arg Ser His His Leu Pro Ser
130 135 140

Glu Leu Ser Gly Gly Gln Lys Gln Arg Val Ala Ile Ala Arg Ala Leu

```
145                 150                 155                 160

Val Asn Asn Pro Ser Ile Ile Leu Ala Asp Glu Pro Thr Gly Ala Leu
                165                 170                 175

Asp Thr Lys Thr Gly Asn Gln Ile Met Gln Leu Leu Val Asp Leu Asn
            180                 185                 190

Lys Glu Gly Lys Thr Ile Ile Met Val Thr His Glu Pro Glu Ile Ala
        195                 200                 205

Ala Tyr Ala Lys Arg Gln Ile Val Ile Arg Asp Gly Val Ile Ser Ser
    210                 215                 220

Asp Ser Ala Gln Leu Gly Lys Glu Glu Asn
225                 230
```

<210> 93
<211> 1200
<212> DNA
<213> Streptococcus pneumoniae

<400> 93
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atgaagaaaa agaatggtaa agctaaaaag tggcaactgt atgcagcaat cggtgctgcg 60
agtgtagttg tattgggtgc tggggggatt ttactcttta gacaaccttc tcagactgct 120
ctaaaagatg agcctactca tcttgttgtt gccaaggaag gaagcgtggc ctcctctgtt 180
ttattgtcag ggacagtaac agcaaaaaat gaacaatatg tttattttga tgctagtaag 240
ggtgatttag atgaaatcct tgtttctgtg ggcgataagg tcagcgaagg gcaggcttta 300
gtcaagtaca gtagttcaga agcgcaggcg gcctatgatt cagctagtcg agcagtagct 360
agggcagatc gtcatatcaa tgaactcaat caagcacgaa atgaagccgc ttcagctccg 420
gctccacagt taccagcgcc agtaggagga gaagatgcaa cggtgcaaag cccaactcca 480
gtggctggaa attctgttgc ttctattgac gctcaattgg gtgatgcccg tgatgcgcgt 540
gcagatgctg cggcgcaatt aagcaaggct caaagtcaat tggatgcaac aactgttctc 600
agtaccctag agggaactgt ggtcgaagtc aatagcaatg tttctaaatc tccaacaggg 660
gcgagtcaag ttatggttca tattgtcagc aatgaaaatt tacaagtcaa gggagaattg 720
tctgagtaca atctagccaa cctttctgta ggtcaagaag taagctttac ttctaaagtg 780
tatcctgata aaaaatggac tgggaaatta agctatattt ctgactatcc taaaaacaat 840
ggtgaagcag ctagtccagc agccgggaat aatacaggtt ctaaataccc ttatactatt 900
gatgtgacag gcgaggttgg tgatttgaaa caaggttttt ctgtcaacat tgaggttaaa 960
agcaaaacta aggctattct tgttcctgtt agcagtctag taatggatga tagtaaaaat 1020
tatgtctgga ttgtggatga acaacaaaag gctaaaaaag ttgaggtttc attgggaaat 1080
gctgacgcag aaaatcaaga aatcacttct ggtttaacga acggtgctaa ggtcatcagt 1140
aatccaacat cttccttgga agaaggaaaa gaggtgaagg ctgatgaagc aactaattag 1200
```

<210> 94
<211> 399
<212> PRT
<213> Streptococcus pneumoniae

<400> 94
```
Met Lys Lys Lys Asn Gly Lys Ala Lys Lys Trp Gln Leu Tyr Ala Ala
  1               5                  10                  15

Ile Gly Ala Ala Ser Val Val Val Leu Gly Ala Gly Gly Ile Leu Leu
```

```
            20                  25                  30

Phe Arg Gln Pro Ser Gln Thr Ala Leu Lys Asp Glu Pro Thr His Leu
         35                  40                  45

Val Val Ala Lys Glu Gly Ser Val Ala Ser Ser Val Leu Leu Ser Gly
     50                  55                  60

Thr Val Thr Ala Lys Asn Glu Gln Tyr Val Tyr Phe Asp Ala Ser Lys
 65                  70                  75                  80

Gly Asp Leu Asp Glu Ile Leu Val Ser Val Gly Asp Lys Val Ser Glu
                 85                  90                  95

Gly Gln Ala Leu Val Lys Tyr Ser Ser Ser Glu Ala Gln Ala Ala Tyr
            100                 105                 110

Asp Ser Ala Ser Arg Ala Val Ala Arg Ala Asp Arg His Ile Asn Glu
        115                 120                 125

Leu Asn Gln Ala Arg Asn Glu Ala Ala Ser Ala Pro Ala Pro Gln Leu
    130                 135                 140

Pro Ala Pro Val Gly Gly Glu Asp Ala Thr Val Gln Ser Pro Thr Pro
145                 150                 155                 160

Val Ala Gly Asn Ser Val Ala Ser Ile Asp Ala Gln Leu Gly Asp Ala
                165                 170                 175

Arg Asp Ala Arg Ala Asp Ala Ala Ala Gln Leu Ser Lys Ala Gln Ser
            180                 185                 190

Gln Leu Asp Ala Thr Thr Val Leu Ser Thr Leu Glu Gly Thr Val Val
        195                 200                 205

Glu Val Asn Ser Asn Val Ser Lys Ser Pro Thr Gly Ala Ser Gln Val
    210                 215                 220

Met Val His Ile Val Ser Asn Glu Asn Leu Gln Val Lys Gly Glu Leu
225                 230                 235                 240

Ser Glu Tyr Asn Leu Ala Asn Leu Ser Val Gly Gln Glu Val Ser Phe
                245                 250                 255

Thr Ser Lys Val Tyr Pro Asp Lys Lys Trp Thr Gly Lys Leu Ser Tyr
            260                 265                 270

Ile Ser Asp Tyr Pro Lys Asn Asn Gly Glu Ala Ala Ser Pro Ala Ala
        275                 280                 285

Gly Asn Asn Thr Gly Ser Lys Tyr Pro Tyr Thr Ile Asp Val Thr Gly
    290                 295                 300

Glu Val Gly Asp Leu Lys Gln Gly Phe Ser Val Asn Ile Glu Val Lys
305                 310                 315                 320

Ser Lys Thr Lys Ala Ile Leu Val Pro Val Ser Ser Leu Val Met Asp
```

```
                325                 330                 335

Asp Ser Lys Asn Tyr Val Trp Ile Val Asp Glu Gln Gln Lys Ala Lys
            340                 345                 350

Lys Val Glu Val Ser Leu Gly Asn Ala Asp Ala Glu Asn Gln Glu Ile
        355                 360                 365

Thr Ser Gly Leu Thr Asn Gly Ala Lys Val Ile Ser Asn Pro Thr Ser
    370                 375                 380

Ser Leu Glu Glu Gly Lys Glu Val Lys Ala Asp Glu Ala Thr Asn
385                 390                 395
```

<210> 95
<211> 759
<212> DNA
<213> Streptococcus pneumoniae

<400> 95
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atgtcacgta aaccatttat cgctggtaac tggaaaatga acaaaaatcc agaagaagct 60
aaagcattcg ttgaagcagt tgcatcaaaa cttccttcat cagatcttgt tgaagcaggt 120
atcgctgctc cagctcttga tttgacaact gttcttgctg ttgcaaaagg ctcaaacctt 180
aaagttgctg ctcaaaactg ctactttgaa aatgcaggtg ctttcactgg tgaaactagc 240
ccacaagttt tgaaagaaat cggtactgac tacgttgtta tcggtcactc agaacgccgt 300
gactacttcc atgaaactga tgaagatatc aacaaaaaag caaaagcaat ctttgcgaac 360
ggtatgcttc caatcatctg ttgtggtgaa tcacttgaaa cttacgaagc tggtaaagct 420
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gctgcctcag ttatcgctta tgagccaatc tgggctatcg gtactggtaa atcagcttca 540
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caagaagtcg cagacaaagt tcgtgttcaa tacggtggtt ctgttaaacc tgaaaatgtt 660
gcttcataca tggcttgccc agacgttgac ggtgcccttg taggtggtgc gtcacttgaa 720
gctgaaagct tcttggcttt gcttgacttt gtaaaataa                          759
```

<210> 96
<211> 252
<212> PRT
<213> Streptococcus pneumoniae

<400> 96
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Met Ser Arg Lys Pro Phe Ile Ala Gly Asn Trp Lys Met Asn Lys Asn
  1               5                  10                  15

Pro Glu Glu Ala Lys Ala Phe Val Glu Ala Val Ala Ser Lys Leu Pro
             20                  25                  30

Ser Ser Asp Leu Val Glu Ala Gly Ile Ala Ala Pro Ala Leu Asp Leu
         35                  40                  45

Thr Thr Val Leu Ala Val Ala Lys Gly Ser Asn Leu Lys Val Ala Ala
     50                  55                  60

Gln Asn Cys Tyr Phe Glu Asn Ala Gly Ala Phe Thr Gly Glu Thr Ser
 65                  70                  75                  80
```

```
Pro Gln Val Leu Lys Glu Ile Gly Thr Asp Tyr Val Val Ile Gly His
                 85                  90                  95

Ser Glu Arg Arg Asp Tyr Phe His Glu Thr Asp Glu Asp Ile Asn Lys
            100                 105                 110

Lys Ala Lys Ala Ile Phe Ala Asn Gly Met Leu Pro Ile Ile Cys Cys
        115                 120                 125

Gly Glu Ser Leu Glu Thr Tyr Glu Ala Gly Lys Ala Ala Glu Phe Val
    130                 135                 140

Gly Ala Gln Val Ser Ala Ala Leu Ala Gly Leu Thr Ala Glu Gln Val
145                 150                 155                 160

Ala Ala Ser Val Ile Ala Tyr Glu Pro Ile Trp Ala Ile Gly Thr Gly
                165                 170                 175

Lys Ser Ala Ser Gln Asp Asp Ala Gln Lys Met Cys Lys Val Val Arg
            180                 185                 190

Asp Val Val Ala Ala Asp Phe Gly Gln Glu Val Ala Asp Lys Val Arg
        195                 200                 205

Val Gln Tyr Gly Gly Ser Val Lys Pro Glu Asn Val Ala Ser Tyr Met
    210                 215                 220

Ala Cys Pro Asp Val Asp Gly Ala Leu Val Gly Gly Ala Ser Leu Glu
225                 230                 235                 240

Ala Glu Ser Phe Leu Ala Leu Leu Asp Phe Val Lys
                245                 250
```

<210> 97
<211> 1473
<212> DNA
<213> Streptococcus pneumoniae

<400> 97

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tcagagcaaa atcagtcttc taataaaacg caaacgagcg cagaagtaca gactaatgct 180
gctgcccact gggatgggga ttattatgta aaggatgatg gttctaaagc tcaaagtgaa 240
tggatttttg acaactacta taaggcttgg ttttatatta attcagatgg tcgttactcg 300
cagaatgaat ggcatggaaa ttactacctg aaatcaggtg gatatatggc ccaaaacgag 360
tggatctatg acagtaatta caagagttgg ttttatctca agtcagatgg ggcttatgct 420
catcaagaat ggcaattgat tggaaataag tggtactact tcaagaagtg gggttacatg 480
gctaaaagcc aatggcaagg aagttatttc ttgaatggtc aaggagctat gatgcaaaat 540
gaatggctct atgatccagc ctattctgct tatttttatc taaaatccga tggaacttat 600
gctaaccaag agtggcaaaa agtgggcggc aaatggtact atttcaagaa gtggggctat 660
atggctcgga atgagtggca aggcaactac tatttgactg gaagtggtgc catggcgact 720
gacgaagtga ttatggatgg tactcgctat atctttgcgg cctctggtga gctcaaagaa 780
aaaaaagatt tgaatgtcgg ctgggttcac agagatggta agcgctattt ctttaataat 840
agagaagaac aagtgggaac cgaacatgct aagaaagtca ttgatattag tgagcacaat 900
```

```
ggtcgtatca atgattggaa aaaggttatt gatgagaacg aagtggatgg tgtcattgtt 960
cgtctaggtt atagcggtaa agaagacaag gaattggcgc ataacattaa ggagttaaac 1020
cgtctgggaa ttccttatgg tgtctatctc tatacctatg ctgaaaatga gaccgatgct 1080
gagagtgacg ctaaacagac cattgaactt ataaagaaat acaatatgaa cctgtcttac 1140
cctatctatt atgatgttga gaattgggaa tatgtaaata agagcaagag agctccaagt 1200
gatacaggca cttgggttaa aatcatcaac aagtacatgg acacgatgaa gcaggcgggt 1260
tatcaaaatg tgtatgtcta tagctatcgt agtttattac agacgcgttt aaaacaccca 1320
gatattttaa aacatgtaaa ctgggtagcg gcctatacga atgctttaga atgggaaaac 1380
cctcattatt caggaaaaaa aggttggcaa tatacctctt ctgaatacat gaaaggaatc 1440
caagggcgcg tagatgtcag cgtttggtat taa                              1473
```

<210> 98
<211> 490
<212> PRT
<213> Streptococcus pneumoniae

<400> 98

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Met Lys Thr Lys Ile Gly Leu Ala Ser Ile Cys Leu Leu Gly Leu Ala
  1               5                  10                  15

Thr Ser His Val Ala Ala Asn Glu Thr Glu Val Ala Lys Thr Ser Gln
             20                  25                  30

Asp Thr Thr Thr Ala Ser Ser Ser Ser Glu Gln Asn Gln Ser Ser Asn
         35                  40                  45

Lys Thr Gln Thr Ser Ala Glu Val Gln Thr Asn Ala Ala Ala His Trp
     50                  55                  60

Asp Gly Asp Tyr Tyr Val Lys Asp Asp Gly Ser Lys Ala Gln Ser Glu
 65                  70                  75                  80

Trp Ile Phe Asp Asn Tyr Tyr Lys Ala Trp Phe Tyr Ile Asn Ser Asp
                 85                  90                  95

Gly Arg Tyr Ser Gln Asn Glu Trp His Gly Asn Tyr Tyr Leu Lys Ser
            100                 105                 110

Gly Gly Tyr Met Ala Gln Asn Glu Trp Ile Tyr Asp Ser Asn Tyr Lys
        115                 120                 125

Ser Trp Phe Tyr Leu Lys Ser Asp Gly Ala Tyr Ala His Gln Glu Trp
    130                 135                 140

Gln Leu Ile Gly Asn Lys Trp Tyr Tyr Phe Lys Lys Trp Gly Tyr Met
145                 150                 155                 160

Ala Lys Ser Gln Trp Gln Gly Ser Tyr Phe Leu Asn Gly Gln Gly Ala
                165                 170                 175

Met Met Gln Asn Glu Trp Leu Tyr Asp Pro Ala Tyr Ser Ala Tyr Phe
            180                 185                 190

Tyr Leu Lys Ser Asp Gly Thr Tyr Ala Asn Gln Glu Trp Gln Lys Val
        195                 200                 205
```

```
Gly Gly Lys Trp Tyr Tyr Phe Lys Lys Trp Gly Tyr Met Ala Arg Asn
    210                 215                 220

Glu Trp Gln Gly Asn Tyr Tyr Leu Thr Gly Ser Gly Ala Met Ala Thr
225                 230                 235                 240

Asp Glu Val Ile Met Asp Gly Thr Arg Tyr Ile Phe Ala Ala Ser Gly
                245                 250                 255

Glu Leu Lys Glu Lys Lys Asp Leu Asn Val Gly Trp Val His Arg Asp
            260                 265                 270

Gly Lys Arg Tyr Phe Phe Asn Asn Arg Glu Glu Gln Val Gly Thr Glu
        275                 280                 285

His Ala Lys Lys Val Ile Asp Ile Ser Glu His Asn Gly Arg Ile Asn
    290                 295                 300

Asp Trp Lys Lys Val Ile Asp Glu Asn Glu Val Asp Gly Val Ile Val
305                 310                 315                 320

Arg Leu Gly Tyr Ser Gly Lys Glu Asp Lys Glu Leu Ala His Asn Ile
                325                 330                 335

Lys Glu Leu Asn Arg Leu Gly Ile Pro Tyr Gly Val Tyr Leu Tyr Thr
            340                 345                 350

Tyr Ala Glu Asn Glu Thr Asp Ala Glu Ser Asp Ala Lys Gln Thr Ile
        355                 360                 365

Glu Leu Ile Lys Lys Tyr Asn Met Asn Leu Ser Tyr Pro Ile Tyr Tyr
    370                 375                 380

Asp Val Glu Asn Trp Glu Tyr Val Asn Lys Ser Lys Arg Ala Pro Ser
385                 390                 395                 400

Asp Thr Gly Thr Trp Val Lys Ile Ile Asn Lys Tyr Met Asp Thr Met
                405                 410                 415

Lys Gln Ala Gly Tyr Gln Asn Val Tyr Val Tyr Ser Tyr Arg Ser Leu
            420                 425                 430

Leu Gln Thr Arg Leu Lys His Pro Asp Ile Leu Lys His Val Asn Trp
        435                 440                 445

Val Ala Ala Tyr Thr Asn Ala Leu Glu Trp Glu Asn Pro His Tyr Ser
    450                 455                 460

Gly Lys Lys Gly Trp Gln Tyr Thr Ser Ser Glu Tyr Met Lys Gly Ile
465                 470                 475                 480

Gln Gly Arg Val Asp Val Ser Val Trp Tyr
                485                 490
```

<210> 99

<211> 774
<212> DNA
<213> Streptococcus pneumoniae

<400> 99
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agctggactc actttgaaac catgtttgga gatgggagac tcatgctgat tttggctcag 180
acatttttct tggccttcct atcagccttg atagcgacca ttatcgggac ttttggtgcc 240
atttacatct accagtctcg taagaaatac caagaagcct ttctatcact caataatatc 300
ctcatggttg cgcctgacgt tatgattggt gctagcttct tgattctctt tacccaactc 360
aagttttcac ttggcttttt gaccgttcta tctagtcacg tggccttctc cattcctatc 420
gtggtcttga tggtcttgcc tcgactcaag gaaatgaatg gcgacatgat tcatgcggcc 480
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ccgtctatca ttactggtta tttcatggcc ttcacctatt cgttagatga ctttgccgtg 600
accttctttg taacaggaaa tggcttttca accctatcag tcgagattta ctctcgtgct 660
cgcaagggga tttccttaga aatcaatgcc ctgtctgctc tagtctttct ctttagtatt 720
atcctagttg taggttatta ctttatctct cgtgagaagg aggagcaagc atga 774

<210> 100
<211> 257
<212> PRT
<213> Streptococcus pneumoniae

<400> 100
Met Lys Lys Phe Ala Asn Leu Tyr Leu Gly Leu Val Phe Leu Val Leu
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Tyr Leu Pro Ile Phe Tyr Leu Ile Gly Tyr Ala Phe Asn Ala Gly Asp
20 25 30

Asp Met Asn Ser Phe Thr Gly Phe Ser Trp Thr His Phe Glu Thr Met
35 40 45

Phe Gly Asp Gly Arg Leu Met Leu Ile Leu Ala Gln Thr Phe Phe Leu
50 55 60

Ala Phe Leu Ser Ala Leu Ile Ala Thr Ile Ile Gly Thr Phe Gly Ala
65 70 75 80

Ile Tyr Ile Tyr Gln Ser Arg Lys Lys Tyr Gln Glu Ala Phe Leu Ser
85 90 95

Leu Asn Asn Ile Leu Met Val Ala Pro Asp Val Met Ile Gly Ala Ser
100 105 110

Phe Leu Ile Leu Phe Thr Gln Leu Lys Phe Ser Leu Gly Phe Leu Thr
115 120 125

Val Leu Ser Ser His Val Ala Phe Ser Ile Pro Ile Val Val Leu Met
130 135 140

Val Leu Pro Arg Leu Lys Glu Met Asn Gly Asp Met Ile His Ala Ala
145 150 155 160

Tyr Asp Leu Gly Ala Ser Gln Phe Gln Met Phe Lys Glu Ile Met Leu

```
                165                 170                 175

Pro Tyr Leu Thr Pro Ser Ile Ile Thr Gly Tyr Phe Met Ala Phe Thr
            180                 185                 190

Tyr Ser Leu Asp Asp Phe Ala Val Thr Phe Phe Val Thr Gly Asn Gly
        195                 200                 205

Phe Ser Thr Leu Ser Val Glu Ile Tyr Ser Arg Ala Arg Lys Gly Ile
    210                 215                 220

Ser Leu Glu Ile Asn Ala Leu Ser Ala Leu Val Phe Leu Phe Ser Ile
225                 230                 235                 240

Ile Leu Val Val Gly Tyr Tyr Phe Ile Ser Arg Glu Lys Glu Glu Gln
                245                 250                 255

Ala
```

<210> 101
<211> 1071
<212> DNA
<213> Streptococcus pneumoniae

<400> 101
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atgaaaaaaa tctattcatt tttagcagga attgcagcga ttatccttgt cttgtgggga 60
attgcgactc atttagatag taaaatcaat agtcgagata gtcaaaaatt ggttatctat 120
aactggggag actatatcga tcctgaactc ttgactcagt ttacagaaga aacaggaatt 180
caagttcagt acgagacttt tgactccaac gaagccatgt acactaagat aaagcagggt 240
ggaacgacct acgatattgc cattccaagt gaatacatga ttaacaagat gaaggacgaa 300
gacctcttgg ttccgcttga ttattcaaaa attgaaggaa tcgaaaatat cggaccagag 360
tttctcaacc agtcctttga cccaggtaat aaattctcca tcccttactt ctggggaacc 420
ttaggaattg tctacaacga aaccatggta gatgaagcgc ctgagcattg ggatgacctt 480
tggaagccgg agtataagaa ttctatcatg ctctttgatg gggcgcgtga ggtgctggga 540
ctaggactca attccctcgg ctacagcctc aactccaagg atctgcagca gttggaagag 600
acagtggata agctctacaa actgactcca aatatcaagg ctatcgttgc ggacgagatg 660
aagggctata tgattcagaa taatgttgca atcggcgtga ccttctctgg tgaagccagc 720
caaatgttag aaaaaaatga aaatctacgt tatgtggtac cgacagaggc cagcaatctt 780
tggtttgaca atatggtcat tcccaaaaca gttaaaaacc aaaactcagc ctatgccttt 840
atcaacttta tgttgaaacc tgaaaatgct ctccaaaatg cggagtatgt cggctattca 900
acaccaaacc taccagcgaa ggaattgctc ccagaggaaa caaaggaaga taaggccttc 960
tatcccgatg ttgaaaccat gaaacaccta gaagtttatg agaaatttga ccataaatgg 1020
acagggaaat atagcgacct cttcctacag tttaaaatgt atcggaagta g          1071
```

<210> 102
<211> 356
<212> PRT
<213> Streptococcus pneumoniae

<400> 102
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Met Lys Lys Ile Tyr Ser Phe Leu Ala Gly Ile Ala Ala Ile Ile Leu
  1               5                  10                  15
```

```
Val Leu Trp Gly Ile Ala Thr His Leu Asp Ser Lys Ile Asn Ser Arg
             20                  25                  30

Asp Ser Gln Lys Leu Val Ile Tyr Asn Trp Gly Asp Tyr Ile Asp Pro
         35                  40                  45

Glu Leu Leu Thr Gln Phe Thr Glu Glu Thr Gly Ile Gln Val Gln Tyr
     50                  55                  60

Glu Thr Phe Asp Ser Asn Glu Ala Met Tyr Thr Lys Ile Lys Gln Gly
 65                  70                  75                  80

Gly Thr Thr Tyr Asp Ile Ala Ile Pro Ser Glu Tyr Met Ile Asn Lys
                 85                  90                  95

Met Lys Asp Glu Asp Leu Leu Val Pro Leu Asp Tyr Ser Lys Ile Glu
            100                 105                 110

Gly Ile Glu Asn Ile Gly Pro Glu Phe Leu Asn Gln Ser Phe Asp Pro
        115                 120                 125

Gly Asn Lys Phe Ser Ile Pro Tyr Phe Trp Gly Thr Leu Gly Ile Val
    130                 135                 140

Tyr Asn Glu Thr Met Val Asp Glu Ala Pro Glu His Trp Asp Asp Leu
145                 150                 155                 160

Trp Lys Pro Glu Tyr Lys Asn Ser Ile Met Leu Phe Asp Gly Ala Arg
                165                 170                 175

Glu Val Leu Gly Leu Gly Leu Asn Ser Leu Gly Tyr Ser Leu Asn Ser
            180                 185                 190

Lys Asp Leu Gln Gln Leu Glu Glu Thr Val Asp Lys Leu Tyr Lys Leu
        195                 200                 205

Thr Pro Asn Ile Lys Ala Ile Val Ala Asp Glu Met Lys Gly Tyr Met
    210                 215                 220

Ile Gln Asn Asn Val Ala Ile Gly Val Thr Phe Ser Gly Glu Ala Ser
225                 230                 235                 240

Gln Met Leu Glu Lys Asn Glu Asn Leu Arg Tyr Val Val Pro Thr Glu
                245                 250                 255

Ala Ser Asn Leu Trp Phe Asp Asn Met Val Ile Pro Lys Thr Val Lys
            260                 265                 270

Asn Gln Asn Ser Ala Tyr Ala Phe Ile Asn Phe Met Leu Lys Pro Glu
        275                 280                 285

Asn Ala Leu Gln Asn Ala Glu Tyr Val Gly Tyr Ser Thr Pro Asn Leu
    290                 295                 300

Pro Ala Lys Glu Leu Leu Pro Glu Glu Thr Lys Glu Asp Lys Ala Phe
305                 310                 315                 320
```

Tyr Pro Asp Val Glu Thr Met Lys His Leu Glu Val Tyr Glu Lys Phe
325 330 335

Asp His Lys Trp Thr Gly Lys Tyr Ser Asp Leu Phe Leu Gln Phe Lys
340 345 350

Met Tyr Arg Lys
355

<210> 103
<211> 1851
<212> DNA
<213> Streptococcus pneumoniae

<400> 103
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tatattttat tttatgggct gattaatcca gcacctgttg actacattat ctatacgagt 180
ttggccttcc tgttctatca attgatgatt ggtttttggg ggttgaacgc gagcattagt 240
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tttatcttgt tgagtacctt cttgatttta ttgccacgga ttacttggca gttaatctac 420
tccagacgca aaaaaggtag tggtgatgga gaacaccgtc ggaccttctt gattggtgcc 480
ggtgatggtg gggctctttt tatggatagt taccaacatc caaccagtga attagaactg 540
gtcggtattt tggataagga ttctaagaaa aagggtcaaa aacttggtgg tattcctgtt 600
ttgggctctt atgacaatct gcctgaatta gccaaacgcc atcaaatcga gcgtgtcatc 660
gttgcgattc cgtcgctgga tccgtcagaa tatgagcgta tcttgcagat gtgtaataag 720
ctgggtgtca aatgttacaa gatgcctaag gttgaaactg ttgttcaggg ccttcaccaa 780
gcaggtactg gcttccaaaa aattgatatt acggaccttt tgggtcgtca ggaaatccgt 840
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caagtctttg agcagtacaa acctgctatt gtttatcatg cggcagccca caagcatgtt 1140
cctatgatgg agcgcaatcc aaaagaagcc ttcaaaaaca atatccgtgg aacttacaat 1200
gttgctaagg ctgttgatga agctaaagtg tctaagatgg ttatgatttc gacagataag 1260
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agccgtggta gtgtcattcc agtctttgaa cgtcagattg ctgaaggtgg gcctgtaacg 1440
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atccatgctg gtgcttatgc caaagatggg gaagtcttta tccttgatat gggcaaacca 1560
gtcaagattt atgacttggc caagaagatg gtgcttctaa gtggccacac tgaaagtgaa 1620
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tcaaccgaac tcgttgataa tcaagttatg gataagattt tcgttggtaa ggttaatgtc 1740
atgcctttag aatccatcaa tcaaaagatt ggagagttcc gcactctcag tggagatgag 1800
ttgaagcaag ctattatcgc ctttgctaat caaacaaccc acattgaata a 1851

<210> 104
<211> 616
<212> PRT
<213> Streptococcus pneumoniae

<400> 104
Met Asn Lys Lys Leu Thr Asp Tyr Val Ile Asp Leu Val Glu Ile Leu

```
  1               5                  10                  15

Asn Lys Gln Gln Lys Gln Val Phe Trp Gly Ile Phe Asp Ile Phe Ser
            20                  25                  30

Met Val Val Ser Ile Ile Val Ser Tyr Ile Leu Phe Tyr Gly Leu Ile
        35                  40                  45

Asn Pro Ala Pro Val Asp Tyr Ile Ile Tyr Thr Ser Leu Ala Phe Leu
    50                  55                  60

Phe Tyr Gln Leu Met Ile Gly Phe Trp Gly Leu Asn Ala Ser Ile Ser
65                  70                  75                  80

Arg Tyr Ser Lys Ile Thr Asp Phe Met Lys Ile Phe Phe Gly Val Thr
                85                  90                  95

Ala Ser Ser Val Leu Ser Tyr Ser Ile Cys Tyr Ala Phe Leu Pro Leu
            100                 105                 110

Phe Ser Ile Arg Phe Ile Ile Leu Phe Ile Leu Leu Ser Thr Phe Leu
        115                 120                 125

Ile Leu Leu Pro Arg Ile Thr Trp Gln Leu Ile Tyr Ser Arg Arg Lys
    130                 135                 140

Lys Gly Ser Gly Asp Gly Glu His Arg Arg Thr Phe Leu Ile Gly Ala
145                 150                 155                 160

Gly Asp Gly Gly Ala Leu Phe Met Asp Ser Tyr Gln His Pro Thr Ser
                165                 170                 175

Glu Leu Glu Leu Val Gly Ile Leu Asp Lys Asp Ser Lys Lys Lys Gly
            180                 185                 190

Gln Lys Leu Gly Gly Ile Pro Val Leu Gly Ser Tyr Asp Asn Leu Pro
        195                 200                 205

Glu Leu Ala Lys Arg His Gln Ile Glu Arg Val Ile Val Ala Ile Pro
    210                 215                 220

Ser Leu Asp Pro Ser Glu Tyr Glu Arg Ile Leu Gln Met Cys Asn Lys
225                 230                 235                 240

Leu Gly Val Lys Cys Tyr Lys Met Pro Lys Val Glu Thr Val Val Gln
                245                 250                 255

Gly Leu His Gln Ala Gly Thr Gly Phe Gln Lys Ile Asp Ile Thr Asp
            260                 265                 270

Leu Leu Gly Arg Gln Glu Ile Arg Leu Asp Glu Ser Arg Leu Gly Ala
        275                 280                 285

Glu Leu Thr Gly Lys Thr Ile Leu Val Thr Gly Ala Gly Gly Ser Ile
    290                 295                 300

Gly Ser Glu Ile Cys Arg Gln Val Ser Arg Phe Asn Pro Glu Arg Ile
```

305 310 315 320

Val Leu Leu Gly His Gly Glu Asn Ser Ile Tyr Leu Val Tyr His Glu
325 330 335

Leu Ile Arg Lys Phe Gln Gly Ile Asp Tyr Val Pro Val Ile Ala Asp
340 345 350

Ile Gln Asp Tyr Asp Arg Leu Leu Gln Val Phe Glu Gln Tyr Lys Pro
355 360 365

Ala Ile Val Tyr His Ala Ala Ala His Lys His Val Pro Met Met Glu
370 375 380

Arg Asn Pro Lys Glu Ala Phe Lys Asn Asn Ile Arg Gly Thr Tyr Asn
385 390 395 400

Val Ala Lys Ala Val Asp Glu Ala Lys Val Ser Lys Met Val Met Ile
405 410 415

Ser Thr Asp Lys Ala Val Asn Pro Pro Asn Val Met Gly Ala Thr Lys
420 425 430

Arg Val Ala Glu Leu Ile Val Thr Gly Phe Asn Gln Arg Ser Gln Ser
435 440 445

Thr Tyr Cys Ala Val Arg Phe Gly Asn Val Leu Gly Ser Arg Gly Ser
450 455 460

Val Ile Pro Val Phe Glu Arg Gln Ile Ala Glu Gly Gly Pro Val Thr
465 470 475 480

Val Thr Asp Phe Arg Met Thr Arg Tyr Phe Met Thr Ile Pro Glu Ala
485 490 495

Ser Arg Leu Val Ile His Ala Gly Ala Tyr Ala Lys Asp Gly Glu Val
500 505 510

Phe Ile Leu Asp Met Gly Lys Pro Val Lys Ile Tyr Asp Leu Ala Lys
515 520 525

Lys Met Val Leu Leu Ser Gly His Thr Glu Ser Glu Ile Pro Ile Val
530 535 540

Glu Val Gly Ile Arg Pro Gly Glu Lys Leu Tyr Glu Glu Leu Leu Val
545 550 555 560

Ser Thr Glu Leu Val Asp Asn Gln Val Met Asp Lys Ile Phe Val Gly
565 570 575

Lys Val Asn Val Met Pro Leu Glu Ser Ile Asn Gln Lys Ile Gly Glu
580 585 590

Phe Arg Thr Leu Ser Gly Asp Glu Leu Lys Gln Ala Ile Ile Ala Phe
595 600 605

Ala Asn Gln Thr Thr His Ile Glu

610 615

<210> 105
<211> 1338
<212> DNA
<213> Streptococcus pneumoniae

<400> 105
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ctgctttctc cttttaccta ttatctaggt tacgaggatg gaaaacctct ctattttaat 180
caagttcccg tttcagattt ttgggaaatt ttaggagata atcagtctgc ttgtattgaa 240
gatgtgacgc aggagagggc tgtcattcat tatgctgatg gaatgcaggc tcgcttggtt 300
aaacaggtag actggaaaga cctagaaggt cgagtacgtc aggttgacca ctacaatcgc 360
ttcggagctt gttttgctac aacgacttat agcgcagata gcgagccgat tatgacagtt 420
taccaagatg tcaatggtca acaagtttta ctggaaaacc atgtgacggg tgatatctta 480
ttgactttgc caggtcagtc catgcgttac tttgcaaata aagttgaatt tatcaccttc 540
tttttgcaag atttggaaat agataccagt cagcttatct ttaatactct agcgactcct 600
ttcttggttt ccttccatca tccagataaa tctggctcgg atgtcttggt atggcaggaa 660
cctctctatg atgccattcc aggtaatatg cagttgattt tggaaagtga taatgtgcgt 720
actaagaaga tcatcattcc aaataaggcg acttatgagc gcgctttaga gttaactgac 780
gagaaatacc atgatcagtt tgtgcacttg ggttatcatt accagttcaa acgtgataat 840
ttcctaagac gagatgcctt aatcttgacc aattcagatc agattgagca agtagaagca 900
atcgcaggag ccttgcctga tgtcactttc cgtattgcag cggtgacaga gatgtcttct 960
aagctcttag acatgctttg ctatcctaat gtggcccttt accagaacgc tagtccacag 1020
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ttgctacagg cagtgcgtca ggcctttgag cacaatctct tgattcttgg ctttaatcag 1140
acggtgcaca atagacttta tatcgctcca gaccatctat ttgaaagtag tgaagttgct 1200
gctttggttg agaccattaa attggccctt tcagatgttg atcaaatgcg tcaggcactt 1260
ggcaaacaag gccaacatgc aaattatgtt gacttggtga gatatcagga aaccatgcaa 1320
actgttttag gaggctaa 1338

<210> 106
<211> 445
<212> PRT
<213> Streptococcus pneumoniae

<400> 106
Met Ile Glu Leu Tyr Asp Ser Tyr Ser Gln Glu Ser Arg Asp Leu His
1 5 10 15

Glu Ser Leu Val Ala Thr Gly Leu Ser Gln Leu Gly Val Val Ile Asp
20 25 30

Ala Asp Gly Phe Leu Pro Asp Gly Leu Leu Ser Pro Phe Thr Tyr Tyr
35 40 45

Leu Gly Tyr Glu Asp Gly Lys Pro Leu Tyr Phe Asn Gln Val Pro Val
50 55 60

Ser Asp Phe Trp Glu Ile Leu Gly Asp Asn Gln Ser Ala Cys Ile Glu
65 70 75 80

Asp Val Thr Gln Glu Arg Ala Val Ile His Tyr Ala Asp Gly Met Gln

```
                85                  90                  95

Ala Arg Leu Val Lys Gln Val Asp Trp Lys Asp Leu Glu Gly Arg Val
            100                 105                 110

Arg Gln Val Asp His Tyr Asn Arg Phe Gly Ala Cys Phe Ala Thr Thr
        115                 120                 125

Thr Tyr Ser Ala Asp Ser Glu Pro Ile Met Thr Val Tyr Gln Asp Val
    130                 135                 140

Asn Gly Gln Gln Val Leu Leu Glu Asn His Val Thr Gly Asp Ile Leu
145                 150                 155                 160

Leu Thr Leu Pro Gly Gln Ser Met Arg Tyr Phe Ala Asn Lys Val Glu
                165                 170                 175

Phe Ile Thr Phe Phe Leu Gln Asp Leu Glu Ile Asp Thr Ser Gln Leu
            180                 185                 190

Ile Phe Asn Thr Leu Ala Thr Pro Phe Leu Val Ser Phe His His Pro
        195                 200                 205

Asp Lys Ser Gly Ser Asp Val Leu Val Trp Gln Glu Pro Leu Tyr Asp
    210                 215                 220

Ala Ile Pro Gly Asn Met Gln Leu Ile Leu Glu Ser Asp Asn Val Arg
225                 230                 235                 240

Thr Lys Lys Ile Ile Ile Pro Asn Lys Ala Thr Tyr Glu Arg Ala Leu
                245                 250                 255

Glu Leu Thr Asp Glu Lys Tyr His Asp Gln Phe Val His Leu Gly Tyr
            260                 265                 270

His Tyr Gln Phe Lys Arg Asp Asn Phe Leu Arg Arg Asp Ala Leu Ile
        275                 280                 285

Leu Thr Asn Ser Asp Gln Ile Glu Gln Val Glu Ala Ile Ala Gly Ala
    290                 295                 300

Leu Pro Asp Val Thr Phe Arg Ile Ala Ala Val Thr Glu Met Ser Ser
305                 310                 315                 320

Lys Leu Leu Asp Met Leu Cys Tyr Pro Asn Val Ala Leu Tyr Gln Asn
                325                 330                 335

Ala Ser Pro Gln Lys Ile Gln Glu Leu Tyr Gln Leu Ser Asp Ile Tyr
            340                 345                 350

Leu Asp Ile Asn His Ser Asn Glu Leu Leu Gln Ala Val Arg Gln Ala
        355                 360                 365

Phe Glu His Asn Leu Leu Ile Leu Gly Phe Asn Gln Thr Val His Asn
    370                 375                 380

Arg Leu Tyr Ile Ala Pro Asp His Leu Phe Glu Ser Ser Glu Val Ala
```

385 390 395 400

Ala Leu Val Glu Thr Ile Lys Leu Ala Leu Ser Asp Val Asp Gln Met
405 410 415

Arg Gln Ala Leu Gly Lys Gln Gly Gln His Ala Asn Tyr Val Asp Leu
420 425 430

Val Arg Tyr Gln Glu Thr Met Gln Thr Val Leu Gly Gly
435 440 445

<210> 107
<211> 1512
<212> DNA
<213> Streptococcus pneumoniae

<400> 107
atgacaattt acaatataaa tttaggaatt ggttgggcta gtagcggtgt tgaatacgct 60
caagcctatc gtgctggtgt ttttcggaaa ttaaatctgt cctctaagtt tatctttaca 120
gatatgattt tagccgataa tattcagcac ttaacagcca atattggttt tgatgataat 180
caggttatct ggctttataa tcatttcaca gatatcaaaa ttgcacctac tagcgtgaca 240
gtggatgatg tcttggctta ctttggtggt gaagaaagtc acagagaaaa aaatggcaag 300
gttttacgtg tattcttttt tgaccaagat aagtttgtaa cctgttattt ggttgatgag 360
aacaaggact tggttcaaca tgccgagtat gtttttaagg gaaacctgat tcggaaggat 420
tacttttctt atacgcgtta ttgtagcgag tattttgctc ccaaggacaa tgttgcagtc 480
ttataccaac gaacttttta taatgaagac gggactccag tctatgatat cttgatgaat 540
caagggaagg aagaagttta tcatttcaag gataagattt tctatggaaa gcaagctttt 600
gtgcgtgcct ttatgaaatc tttgaatttg aataagtctg atttggtcat tctcgatagg 660
gagacaggta ttggacaggt tgtgtttgag gaagcacaga cagcacatct agcggtagtt 720
gttcatgcgg agcattatag tgaaaatgct acaaatgagg actatatcct ttggaataac 780
tattatgact atcagtttac caatgcagat aaggttgact tctttatcgt gtctactgat 840
agacaaaatg aagttctaca agagcaattt gccaaatata ctcagcatca gccaaagatt 900
gttaccattc ctgtaggcag tattgattcc ttgacagatt caagtcaagg gcgcaaacca 960
ttttcattga ttacggcttc acgtcttgcc aaagaaaagc acattgattg gcttgtgaaa 1020
gctgtgattg aagctcataa ggagttaccg gaactaacct ttgatatcta tggtagtggt 1080
ggagaagatt ctctgcttag agaaattatt gcaaatcatc aggcagagga ctatatccaa 1140
ctcaaggggc atgcggaact ttcgcagatt tatagccagt atgaggtcta cttaacggct 1200
tctaccagcg aaggatttgg tctgaccttg atggaagcta ttggttcagg tctacctcta 1260
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ttgattccaa gttcatctga ccatgtagaa gaccaaatca agcaagctta tgccgctaag 1380
atttgtcaat tgtatcaaga aaatcgtttg gaagctatgc gtgcctattc ttaccaaatt 1440
gcagaaggct tcttgaccaa agaaatttta gaaaagtgga agaaaacagt agaggaggtg 1500
ctccatgatt ga 1512

<210> 108
<211> 503
<212> PRT
<213> Streptococcus pneumoniae

<400> 108
Met Thr Ile Tyr Asn Ile Asn Leu Gly Ile Gly Trp Ala Ser Ser Gly
1 5 10 15

Val Glu Tyr Ala Gln Ala Tyr Arg Ala Gly Val Phe Arg Lys Leu Asn

```
            20                  25                  30

Leu Ser Ser Lys Phe Ile Phe Thr Asp Met Ile Leu Ala Asp Asn Ile
         35                  40                  45

Gln His Leu Thr Ala Asn Ile Gly Phe Asp Asp Asn Gln Val Ile Trp
     50                  55                  60

Leu Tyr Asn His Phe Thr Asp Ile Lys Ile Ala Pro Thr Ser Val Thr
 65                  70                  75                  80

Val Asp Asp Val Leu Ala Tyr Phe Gly Gly Glu Glu Ser His Arg Glu
                 85                  90                  95

Lys Asn Gly Lys Val Leu Arg Val Phe Phe Phe Asp Gln Asp Lys Phe
            100                 105                 110

Val Thr Cys Tyr Leu Val Asp Glu Asn Lys Asp Leu Val Gln His Ala
        115                 120                 125

Glu Tyr Val Phe Lys Gly Asn Leu Ile Arg Lys Asp Tyr Phe Ser Tyr
    130                 135                 140

Thr Arg Tyr Cys Ser Glu Tyr Phe Ala Pro Lys Asp Asn Val Ala Val
145                 150                 155                 160

Leu Tyr Gln Arg Thr Phe Tyr Asn Glu Asp Gly Thr Pro Val Tyr Asp
                165                 170                 175

Ile Leu Met Asn Gln Gly Lys Glu Glu Val Tyr His Phe Lys Asp Lys
            180                 185                 190

Ile Phe Tyr Gly Lys Gln Ala Phe Val Arg Ala Phe Met Lys Ser Leu
        195                 200                 205

Asn Leu Asn Lys Ser Asp Leu Val Ile Leu Asp Arg Glu Thr Gly Ile
    210                 215                 220

Gly Gln Val Val Phe Glu Glu Ala Gln Thr Ala His Leu Ala Val Val
225                 230                 235                 240

Val His Ala Glu His Tyr Ser Glu Asn Ala Thr Asn Glu Asp Tyr Ile
                245                 250                 255

Leu Trp Asn Asn Tyr Tyr Asp Tyr Gln Phe Thr Asn Ala Asp Lys Val
            260                 265                 270

Asp Phe Phe Ile Val Ser Thr Asp Arg Gln Asn Glu Val Leu Gln Glu
        275                 280                 285

Gln Phe Ala Lys Tyr Thr Gln His Gln Pro Lys Ile Val Thr Ile Pro
    290                 295                 300

Val Gly Ser Ile Asp Ser Leu Thr Asp Ser Ser Gln Gly Arg Lys Pro
305                 310                 315                 320

Phe Ser Leu Ile Thr Ala Ser Arg Leu Ala Lys Glu Lys His Ile Asp
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                325                 330                 335

Trp Leu Val Lys Ala Val Ile Glu Ala His Lys Glu Leu Pro Glu Leu
            340                 345                 350

Thr Phe Asp Ile Tyr Gly Ser Gly Gly Glu Asp Ser Leu Leu Arg Glu
        355                 360                 365

Ile Ile Ala Asn His Gln Ala Glu Asp Tyr Ile Gln Leu Lys Gly His
    370                 375                 380

Ala Glu Leu Ser Gln Ile Tyr Ser Gln Tyr Glu Val Tyr Leu Thr Ala
385                 390                 395                 400

Ser Thr Ser Glu Gly Phe Gly Leu Thr Leu Met Glu Ala Ile Gly Ser
                405                 410                 415

Gly Leu Pro Leu Ile Gly Phe Asp Val Pro Tyr Gly Asn Gln Thr Phe
            420                 425                 430

Ile Glu Asp Gly Gln Asn Gly Tyr Leu Ile Pro Ser Ser Ser Asp His
        435                 440                 445

Val Glu Asp Gln Ile Lys Gln Ala Tyr Ala Ala Lys Ile Cys Gln Leu
    450                 455                 460

Tyr Gln Glu Asn Arg Leu Glu Ala Met Arg Ala Tyr Ser Tyr Gln Ile
465                 470                 475                 480

Ala Glu Gly Phe Leu Thr Lys Glu Ile Leu Glu Lys Trp Lys Lys Thr
                485                 490                 495

Val Glu Glu Val Leu His Asp
            500
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<210> 109
<211> 2292
<212> DNA
<213> Streptococcus pneumoniae

<400> 109
atgtcctctc tttcggatca agaattagta gctaaaacag tagagtttcg tcagcgtctt 60
tccgagggag aaagtctaga cgatattttg gttgaagctt ttgctgtggt gcgtgaagca 120
gataagcgga ttttagggat gtttccttat gatgttcaag tcatgggagc tattgtcatg 180
cactatggaa atgttgctga gatgaatacg ggggaaggta agaccttgac agctaccatg 240
cctgtctatt tgaacgcttt ttcaggagaa ggagtgatgg ttgtgactcc taatgagtat 300
ttatcaaagc gtgatgccga ggaaatgggt caagtttatc gttttctagg attgaccatt 360
ggtgtaccat ttacggaaga tccaaagaag gagatgaaag ctgaagaaaa gaagcttatc 420
tatgcttcgg atatcatcta cacaaccaat agtaatttag gttttgatta tctaaatgat 480
aacctagcct cgaatgaaga aggtaagttt ttacgaccgt ttaactatgt gattattgat 540
gaaattgatg atatcttgct tgatagtgca caaactcctc tgattattgc gggttctcct 600
cgtgttcagt ctaattacta tgcgatcatt gatacacttg taacaacctt ggtcgaagga 660
gaggattata tctttaaaga ggagaaagag gaggtttggc tcactactaa gggggccaag 720
tctgctgaga atttcctagg gattgataat ttatacaagg aagagcatgc gtcttttgct 780
cgtcatttgg tttatgcgat tcgagctcat aagctcttta ctaaagataa ggactatatc 840

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attcgtggaa atgagatggt actggttgat aagggaacag ggcgtctaat ggaaatgact 900
aaacttcaag gaggtctcca tcaggctatt gaagccaagg aacatgtcaa attatctcct 960
gagacgcggg ctatggcctc gatcacctat cagagtcttt ttaagatgtt taataagata 1020
tctggtatga cagggacagg taaggtcgcg gaaaaagagt ttattgaaac ttacaatatg 1080
tctgtagtac gcattccaac caatcgtccg agacaacgga ttgactatcc agataatcta 1140
tatatcactt tacctgaaaa agtgtatgca tccttggagt acatcaagca ataccatgct 1200
aagggaaatc ctttactcgt ttttgtaggc tcagttgaaa tgtctcaact ctattcgtct 1260
ctcttgtttc gtgaagggat tgcccataat gtcctaaatg ctaataatgc ggcgcgtgag 1320
gctcagatta tctccgagtc aggtcagatg ggggctgtga cagtggctac ctctatggca 1380
ggacgtggta cggatatcaa gcttggtaaa ggagtcgcag agcttggggg cttgattgtt 1440
attgggactg agcggatgga aagtcagcgg atcgacctac aaattcgtgg ccgttctggt 1500
cgtcagggag atcctggtat gagtaaattt tttgtatcct tagaggatga tgttatcaag 1560
aaatttggtc catcttgggt gcataaaaag tacaaagact atcaggttca agatatgact 1620
caaccggaag tattgaaagg tcgtaaatac cggaaactag tcgaaaaggc tcagcatgcc 1680
agtgatagtg ctggacgttc agcacgtcgt cagactctgg agtatgctga aagtatgaat 1740
atacaacggg atatagtcta taaagagaga aatcgtctaa tagatggttc tcgtgactta 1800
gaggatgttg ttgtggatat cattgagaga tatacagaag aggtagcggc tgatcactat 1860
gctagtcgtg aattattgtt tcactttatt gtgaccaata ttagttttca tgttaaagag 1920
gttccagatt atatagatgt aactgacaaa actgcagttc gtagctttat gaagcaggtg 1980
attgataaag aactttctga aaagaaagaa ttacttaatc aacatgactt atatgaacag 2040
tttttacgac tttcactgct taaagccatt gatgacaact gggtagagca ggtagactat 2100
ctacaacagc tatccatggc tatcggtggt caatctgcta gtcagaaaaa tccaatcgta 2160
gagtactatc aagaagccta cgcgggcttt gaagctatga aagaacagat tcatgcggat 2220
atggtgcgta atctcctgat ggggctggtt gaggtcactc caaaaggtga aatcgtgact 2280
cattttccat aa                                                    2292
```

<210> 110
<211> 763
<212> PRT
<213> Streptococcus pneumoniae

<400> 110

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Met Ser Ser Leu Ser Asp Gln Glu Leu Val Ala Lys Thr Val Glu Phe
  1               5                  10                  15

Arg Gln Arg Leu Ser Glu Gly Glu Ser Leu Asp Asp Ile Leu Val Glu
             20                  25                  30

Ala Phe Ala Val Val Arg Glu Ala Asp Lys Arg Ile Leu Gly Met Phe
         35                  40                  45

Pro Tyr Asp Val Gln Val Met Gly Ala Ile Val Met His Tyr Gly Asn
     50                  55                  60

Val Ala Glu Met Asn Thr Gly Glu Gly Lys Thr Leu Thr Ala Thr Met
 65                  70                  75                  80

Pro Val Tyr Leu Asn Ala Phe Ser Gly Glu Gly Val Met Val Val Thr
                 85                  90                  95

Pro Asn Glu Tyr Leu Ser Lys Arg Asp Ala Glu Glu Met Gly Gln Val
            100                 105                 110

Tyr Arg Phe Leu Gly Leu Thr Ile Gly Val Pro Phe Thr Glu Asp Pro
        115                 120                 125
```

```
Lys Lys Glu Met Lys Ala Glu Glu Lys Lys Leu Ile Tyr Ala Ser Asp
    130                 135                 140

Ile Ile Tyr Thr Thr Asn Ser Asn Leu Gly Phe Asp Tyr Leu Asn Asp
145                 150                 155                 160

Asn Leu Ala Ser Asn Glu Glu Gly Lys Phe Leu Arg Pro Phe Asn Tyr
                165                 170                 175

Val Ile Ile Asp Glu Ile Asp Asp Ile Leu Leu Asp Ser Ala Gln Thr
            180                 185                 190

Pro Leu Ile Ile Ala Gly Ser Pro Arg Val Gln Ser Asn Tyr Tyr Ala
        195                 200                 205

Ile Ile Asp Thr Leu Val Thr Thr Leu Val Glu Gly Glu Asp Tyr Ile
    210                 215                 220

Phe Lys Glu Glu Lys Glu Glu Val Trp Leu Thr Thr Lys Gly Ala Lys
225                 230                 235                 240

Ser Ala Glu Asn Phe Leu Gly Ile Asp Asn Leu Tyr Lys Glu Glu His
                245                 250                 255

Ala Ser Phe Ala Arg His Leu Val Tyr Ala Ile Arg Ala His Lys Leu
            260                 265                 270

Phe Thr Lys Asp Lys Asp Tyr Ile Ile Arg Gly Asn Glu Met Val Leu
        275                 280                 285

Val Asp Lys Gly Thr Gly Arg Leu Met Glu Met Thr Lys Leu Gln Gly
    290                 295                 300

Gly Leu His Gln Ala Ile Glu Ala Lys Glu His Val Lys Leu Ser Pro
305                 310                 315                 320

Glu Thr Arg Ala Met Ala Ser Ile Thr Tyr Gln Ser Leu Phe Lys Met
                325                 330                 335

Phe Asn Lys Ile Ser Gly Met Thr Gly Thr Gly Lys Val Ala Glu Lys
            340                 345                 350

Glu Phe Ile Glu Thr Tyr Asn Met Ser Val Val Arg Ile Pro Thr Asn
        355                 360                 365

Arg Pro Arg Gln Arg Ile Asp Tyr Pro Asp Asn Leu Tyr Ile Thr Leu
    370                 375                 380

Pro Glu Lys Val Tyr Ala Ser Leu Glu Tyr Ile Lys Gln Tyr His Ala
385                 390                 395                 400

Lys Gly Asn Pro Leu Leu Val Phe Val Gly Ser Val Glu Met Ser Gln
                405                 410                 415

Leu Tyr Ser Ser Leu Leu Phe Arg Glu Gly Ile Ala His Asn Val Leu
            420                 425                 430
```

Asn Ala Asn Asn Ala Ala Arg Glu Ala Gln Ile Ile Ser Glu Ser Gly
435 440 445

Gln Met Gly Ala Val Thr Val Ala Thr Ser Met Ala Gly Arg Gly Thr
450 455 460

Asp Ile Lys Leu Gly Lys Gly Val Ala Glu Leu Gly Gly Leu Ile Val
465 470 475 480

Ile Gly Thr Glu Arg Met Glu Ser Gln Arg Ile Asp Leu Gln Ile Arg
485 490 495

Gly Arg Ser Gly Arg Gln Gly Asp Pro Gly Met Ser Lys Phe Phe Val
500 505 510

Ser Leu Glu Asp Asp Val Ile Lys Lys Phe Gly Pro Ser Trp Val His
515 520 525

Lys Lys Tyr Lys Asp Tyr Gln Val Gln Asp Met Thr Gln Pro Glu Val
530 535 540

Leu Lys Gly Arg Lys Tyr Arg Lys Leu Val Glu Lys Ala Gln His Ala
545 550 555 560

Ser Asp Ser Ala Gly Arg Ser Ala Arg Arg Gln Thr Leu Glu Tyr Ala
565 570 575

Glu Ser Met Asn Ile Gln Arg Asp Ile Val Tyr Lys Glu Arg Asn Arg
580 585 590

Leu Ile Asp Gly Ser Arg Asp Leu Glu Asp Val Val Val Asp Ile Ile
595 600 605

Glu Arg Tyr Thr Glu Glu Val Ala Ala Asp His Tyr Ala Ser Arg Glu
610 615 620

Leu Leu Phe His Phe Ile Val Thr Asn Ile Ser Phe His Val Lys Glu
625 630 635 640

Val Pro Asp Tyr Ile Asp Val Thr Asp Lys Thr Ala Val Arg Ser Phe
645 650 655

Met Lys Gln Val Ile Asp Lys Glu Leu Ser Glu Lys Lys Glu Leu Leu
660 665 670

Asn Gln His Asp Leu Tyr Glu Gln Phe Leu Arg Leu Ser Leu Leu Lys
675 680 685

Ala Ile Asp Asp Asn Trp Val Glu Gln Val Asp Tyr Leu Gln Gln Leu
690 695 700

Ser Met Ala Ile Gly Gly Gln Ser Ala Ser Gln Lys Asn Pro Ile Val
705 710 715 720

Glu Tyr Tyr Gln Glu Ala Tyr Ala Gly Phe Glu Ala Met Lys Glu Gln
725 730 735

```
Ile His Ala Asp Met Val Arg Asn Leu Leu Met Gly Leu Val Glu Val
            740                 745                 750

Thr Pro Lys Gly Glu Ile Val Thr His Phe Pro
        755                 760
```

<210> 111
<211> 879
<212> DNA
<213> Streptococcus pneumoniae

<400> 111
atgaaacaag aatggtttga aagtaatgat tttgtaaaaa caacaagcaa gaacaagcct 60
gaagagcaag ctcaagaggt tgcagacaag gctgaagaaa ggatacccga tctcgataca 120
ccaattgaaa aaaatactca gttagaggag gaagtctctc aagctgaagt cgaattggaa 180
agccagcaag aagagaaaat tgaagctcct gaagacagtg aagcgagaac agaaatagaa 240
gaaaagaagg catctaattc tactgaagaa gagccagacc tttctaaaga aacagaaaaa 300
gtcactatag ctgaagagag ccaagaagct cttcctcagc aaaaagcaac cacgaaagag 360
ccacttctta tcagtaaatc tttagaaagt ccttatatcc ccgaccaagc tccaaaatct 420
agggataaat ggaaagagca agtgcttgat ttttggtctt ggctagtgga agcgatcaaa 480
tctcctacaa gtaagttgga aacaagtatc acacacagtt acacagcctt tctcttgctc 540
attctgtttt ctgcatcttc ctttttcttt agtatctatc acatcaaaca tgcttactat 600
ggacatatag caagcattaa cagtcgcttc cctgagcagc tagctccttt aactcttttt 660
tctatcatct ctatcctagt agcgacaaca ctcttcttct tttcattcct cttgggtagt 720
ttcgttgtga gacgatttat ccaccaggaa aaggactgga cgctagacaa ggttctccaa 780
caatatagtc aactcttggc aattccaatc tcctcactgc tattgctagt ttctttgctt 840
tctttgatag cctacgattt acagccctct tgtgtgtga   879

<210> 112
<211> 292
<212> PRT
<213> Streptococcus pneumoniae

<400> 112
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Met Lys Gln Glu Trp Phe Glu Ser Asn Asp Phe Val Lys Thr Thr Ser
  1               5                  10                  15

Lys Asn Lys Pro Glu Glu Gln Ala Gln Glu Val Ala Asp Lys Ala Glu
            20                  25                  30

Glu Arg Ile Pro Asp Leu Asp Thr Pro Ile Glu Lys Asn Thr Gln Leu
        35                  40                  45

Glu Glu Glu Val Ser Gln Ala Glu Val Glu Leu Glu Ser Gln Gln Glu
    50                  55                  60

Glu Lys Ile Glu Ala Pro Glu Asp Ser Glu Ala Arg Thr Glu Ile Glu
65                  70                  75                  80

Glu Lys Lys Ala Ser Asn Ser Thr Glu Glu Glu Pro Asp Leu Ser Lys
                85                  90                  95

Glu Thr Glu Lys Val Thr Ile Ala Glu Glu Ser Gln Glu Ala Leu Pro
            100                 105                 110
```

```
Gln Gln Lys Ala Thr Thr Lys Glu Pro Leu Leu Ile Ser Lys Ser Leu
        115                 120                 125

Glu Ser Pro Tyr Ile Pro Asp Gln Ala Pro Lys Ser Arg Asp Lys Trp
    130                 135                 140

Lys Glu Gln Val Leu Asp Phe Trp Ser Trp Leu Val Glu Ala Ile Lys
145                 150                 155                 160

Ser Pro Thr Ser Lys Leu Glu Thr Ser Ile Thr His Ser Tyr Thr Ala
                165                 170                 175

Phe Leu Leu Leu Ile Leu Phe Ser Ala Ser Ser Phe Phe Phe Ser Ile
            180                 185                 190

Tyr His Ile Lys His Ala Tyr Tyr Gly His Ile Ala Ser Ile Asn Ser
        195                 200                 205

Arg Phe Pro Glu Gln Leu Ala Pro Leu Thr Leu Phe Ser Ile Ile Ser
    210                 215                 220

Ile Leu Val Ala Thr Thr Leu Phe Phe Phe Ser Phe Leu Leu Gly Ser
225                 230                 235                 240

Phe Val Val Arg Arg Phe Ile His Gln Glu Lys Asp Trp Thr Leu Asp
                245                 250                 255

Lys Val Leu Gln Gln Tyr Ser Gln Leu Leu Ala Ile Pro Ile Ser Ser
            260                 265                 270

Leu Leu Leu Leu Val Ser Leu Leu Ser Leu Ile Ala Tyr Asp Leu Gln
        275                 280                 285

Pro Ser Cys Val
    290
```

<210> 113
<211> 327
<212> DNA
<213> Streptococcus pneumoniae

<400> 113
atgtactttc caacatcctc tgccttgatt gaatttctca tcttggctgt actggagcag 60
ggtgattctt atggttatga gattagccaa accattaagc tgatcgctaa tatcaaagaa 120
tccacactct atcccattct caaaaaattg gaaggcaata gctttctgac aacctattct 180
agagagttcc aaggtcgcat gcgcaaatac tactccttga caaacggtgg tatagagcag 240
ctcttgaccc taaaagatga atgggcactc tatacagaca ccatcaatgg catcatagaa 300
gggagtatcc gccatgacaa gaactga 327

<210> 114
<211> 108
<212> PRT
<213> Streptococcus pneumoniae

<400> 114
Met Tyr Phe Pro Thr Ser Ser Ala Leu Ile Glu Phe Leu Ile Leu Ala
1 5 10 15

Val Leu Glu Gln Gly Asp Ser Tyr Gly Tyr Glu Ile Ser Gln Thr Ile
20 25 30

Lys Leu Ile Ala Asn Ile Lys Glu Ser Thr Leu Tyr Pro Ile Leu Lys
35 40 45

Lys Leu Glu Gly Asn Ser Phe Leu Thr Thr Tyr Ser Arg Glu Phe Gln
50 55 60

Gly Arg Met Arg Lys Tyr Tyr Ser Leu Thr Asn Gly Gly Ile Glu Gln
65 70 75 80

Leu Leu Thr Leu Lys Asp Glu Trp Ala Leu Tyr Thr Asp Thr Ile Asn
85 90 95

Gly Ile Ile Glu Gly Ser Ile Arg His Asp Lys Asn
100 105

<210> 115
<211> 954
<212> DNA
<213> Streptococcus pneumoniae

<400> 115
atggattttg aaaaaattga acaagcttat atctatttac tagagaatgt ccaagtcatc 60
caaagtgatt tggcgaccaa cttttatgac gccttggtgg agcaaaatag catctatctg 120
gatggtgaaa ctgagctaaa ccaggtcaaa gacaacaatc aggcccttaa gcgtttagca 180
ctacgcaaag aagaatggct caagacctac cagtttctct tgatgaaggc tgggcaaaca 240
gaacccttgc aggccaatca ccagtttaca ccggatgcta ttgctttgct tttggtgttt 300
attgtggaag agttgtttaa agaggaggaa attactatcc tcgaaatggg ttctgggatg 360
ggaattctag gcgctatttt cttgacctcg cttactaaaa aggtggatta cttgggaatg 420
gaagtggatg atttgctgat tgatctggca gctagcatgg cagatgtaat tggtttgcag 480
gctggctttg tccaaggaga tgccgttcgc ccacaaatgc tcaaagaaag cgatgtggtc 540
atcagtgact tgcctgtcgg ctattatcct gatgatgccg ttgcgtcgcg ccatcaagtt 600
gcttctagcc aagaacatac ttacgcccat cacttgctca tggaacaagg gcttaagtac 660
ctcaagtcag acggatacgc tatttttcta gctccgagtg atttgttgac cagtcctcaa 720
agtgatttgt taaaagaatg gctgaaagaa gaggcgagtc tggttgctat gattagtctg 780
cctgaaaatc tctttgctaa tgccaaacaa tctaagacta tttttatctt acagaagaaa 840
aatgaaatag cagtagagcc ttttgtttat ccacttgcta gcttgcaaga tgcaagtgtt 900
ttaatgaaat ttaaagaaaa ttttcaaaaa tggactcaag gtactgaaat ataa 954

<210> 116
<211> 317
<212> PRT
<213> Streptococcus pneumoniae

<400> 116
Met Asp Phe Glu Lys Ile Glu Gln Ala Tyr Ile Tyr Leu Leu Glu Asn
1 5 10 15

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Val Gln Val Ile Gln Ser Asp Leu Ala Thr Asn Phe Tyr Asp Ala Leu
            20                  25                  30

Val Glu Gln Asn Ser Ile Tyr Leu Asp Gly Glu Thr Glu Leu Asn Gln
        35                  40                  45

Val Lys Asp Asn Asn Gln Ala Leu Lys Arg Leu Ala Leu Arg Lys Glu
    50                  55                  60

Glu Trp Leu Lys Thr Tyr Gln Phe Leu Leu Met Lys Ala Gly Gln Thr
65                  70                  75                  80

Glu Pro Leu Gln Ala Asn His Gln Phe Thr Pro Asp Ala Ile Ala Leu
                85                  90                  95

Leu Leu Val Phe Ile Val Glu Glu Leu Phe Lys Glu Glu Glu Ile Thr
            100                 105                 110

Ile Leu Glu Met Gly Ser Gly Met Gly Ile Leu Gly Ala Ile Phe Leu
        115                 120                 125

Thr Ser Leu Thr Lys Lys Val Asp Tyr Leu Gly Met Glu Val Asp Asp
    130                 135                 140

Leu Leu Ile Asp Leu Ala Ala Ser Met Ala Asp Val Ile Gly Leu Gln
145                 150                 155                 160

Ala Gly Phe Val Gln Gly Asp Ala Val Arg Pro Gln Met Leu Lys Glu
                165                 170                 175

Ser Asp Val Val Ile Ser Asp Leu Pro Val Gly Tyr Tyr Pro Asp Asp
            180                 185                 190

Ala Val Ala Ser Arg His Gln Val Ala Ser Ser Gln Glu His Thr Tyr
        195                 200                 205

Ala His His Leu Leu Met Glu Gln Gly Leu Lys Tyr Leu Lys Ser Asp
    210                 215                 220

Gly Tyr Ala Ile Phe Leu Ala Pro Ser Asp Leu Leu Thr Ser Pro Gln
225                 230                 235                 240

Ser Asp Leu Leu Lys Glu Trp Leu Lys Glu Glu Ala Ser Leu Val Ala
                245                 250                 255

Met Ile Ser Leu Pro Glu Asn Leu Phe Ala Asn Ala Lys Gln Ser Lys
            260                 265                 270

Thr Ile Phe Ile Leu Gln Lys Lys Asn Glu Ile Ala Val Glu Pro Phe
        275                 280                 285

Val Tyr Pro Leu Ala Ser Leu Gln Asp Ala Ser Val Leu Met Lys Phe
    290                 295                 300

Lys Glu Asn Phe Gln Lys Trp Thr Gln Gly Thr Glu Ile
305                 310                 315
```

<210> 117
<211> 1902
<212> DNA
<213> Streptococcus pneumoniae

<400> 117
atgattattt tacaagctaa taaaattgaa cgttcttttg caggagaggt tcttttcgat 60
aatatcaacc tgcaggttga tgaacgagat cggattgctc ttgttgggaa aaatggtgca 120
ggtaagtcta ctcttttgaa gattttagtt ggagaagagg agccaactag cggagaaatc 180
aataagaaaa aagatatttc tctgtcttac ctagcccaag atagccgttt tgagtctgaa 240
aataccatct acgatgaaat gcttcatgtc tttaatgatt tgcgtcggac ggagagacaa 300
ctgcgtcaga tggagctgga gatgggtgaa aagtctggtg aggatttgga taaactgatg 360
tcagattatg accgcttatc tgagaatttt cgccaagcag gtggctttac ctatgaagct 420
gatattcgag cgattttgaa tggattcaag tttgacgagt ctatgtggca gatgaaaatt 480
gctgagcttt ctggtggtca aaatactcgt ttggcacttg ccaaaatgct ccttgaaaag 540
cccaatctct tggtcttgga cgagccaact aaccacttgg atattgaaac catcgcctgg 600
ctagagaatt acttggtaaa ctatagcggt gccctcatta tcgtcagcca cgaccgttat 660
ttcttggaca aggttgcgac aattacgcta gatttgacca agcattcctt ggatcgctat 720
gtggggaatt actctcgttt tgtcgaattg aaggagcaaa agctagttac tgaggcaaaa 780
aactatgaaa agcaacagaa ggaaatcgct gctctggaag actttgtcaa tcgcaatcta 840
gttcgtgctt caacgactaa acgtgctcaa tctcgccgta aacaactaga aaaaatggag 900
cgtttggaca agcctgaagc tggcaagaaa gcagccaaca tgaccttcca gtctgaaaaa 960
acgtcgggca atgttgtttt gactgttgaa aatgcagctg ttggctatga cggggaagtc 1020
ttgtcacaac ctatcaacct agatcttcgt aagatgaatg ctgtcgctat cgttggtcca 1080
aatggtatcg gcaagtcaac ctttatcaag tctattgtgg accagattcc ttttatcaag 1140
ggagaaaagc gctttggcgc taatgttgag gttggttact atgaccaaac ccaaagcaag 1200
ctgacaccaa gtaatacggt gctggatgaa ctctggaatg atttcaaact gacaccagaa 1260
gttgaaatcc gcaaccgtct tggagccttc cttttctcag gagatgatgt taaaaaatca 1320
gtcggcatgc tatctggtgg cgaaaaagct cgtttgcttt tagctaaatt gtctatggaa 1380
aacaataact ttttgattct ggatgagccg accaaccact tggatattga tagtaaggaa 1440
gtgctagaaa atgccttgat tgactttgat ggaaccttgc tgtttgtcag tcatgatcgt 1500
tactttatca atcgtgtggc aactcatgtt ttggaattgt ctgagaatgg ttcaactctc 1560
taccttggag attacgacta ctatgttgag aagaaagcaa cagcagaaat gagtcagact 1620
gaggaagctt caactagcaa tcaagcaaag gaagcaagtc cagtcaatga ctatcaggcc 1680
cagaaagaaa gtcaaaaaga agttcgcaaa ctcatgcgac aaatcgaaag tctagaagct 1740
gaaattgaag agctagaaag tcaaagccaa gccatttctg aacaaatgtt ggaaacaaac 1800
gatgccgaca aactcatgga attacaggct gagctggaca aaatcagcca tcgtcaggaa 1860
gaagctatgc ttgagtggga agaattatca gagcaggtgt aa 1902

<210> 118
<211> 633
<212> PRT
<213> Streptococcus pneumoniae

<400> 118
Met Ile Ile Leu Gln Ala Asn Lys Ile Glu Arg Ser Phe Ala Gly Glu
1 5 10 15

Val Leu Phe Asp Asn Ile Asn Leu Gln Val Asp Glu Arg Asp Arg Ile
20 25 30

Ala Leu Val Gly Lys Asn Gly Ala Gly Lys Ser Thr Leu Leu Lys Ile
35 40 45

```
Leu Val Gly Glu Glu Glu Pro Thr Ser Gly Glu Ile Asn Lys Lys Lys
     50                  55                  60

Asp Ile Ser Leu Ser Tyr Leu Ala Gln Asp Ser Arg Phe Glu Ser Glu
 65                  70                  75                  80

Asn Thr Ile Tyr Asp Glu Met Leu His Val Phe Asn Asp Leu Arg Arg
                 85                  90                  95

Thr Glu Arg Gln Leu Arg Gln Met Glu Leu Glu Met Gly Glu Lys Ser
            100                 105                 110

Gly Glu Asp Leu Asp Lys Leu Met Ser Asp Tyr Asp Arg Leu Ser Glu
        115                 120                 125

Asn Phe Arg Gln Ala Gly Gly Phe Thr Tyr Glu Ala Asp Ile Arg Ala
    130                 135                 140

Ile Leu Asn Gly Phe Lys Phe Asp Glu Ser Met Trp Gln Met Lys Ile
145                 150                 155                 160

Ala Glu Leu Ser Gly Gly Gln Asn Thr Arg Leu Ala Leu Ala Lys Met
                165                 170                 175

Leu Leu Glu Lys Pro Asn Leu Leu Val Leu Asp Glu Pro Thr Asn His
            180                 185                 190

Leu Asp Ile Glu Thr Ile Ala Trp Leu Glu Asn Tyr Leu Val Asn Tyr
        195                 200                 205

Ser Gly Ala Leu Ile Ile Val Ser His Asp Arg Tyr Phe Leu Asp Lys
    210                 215                 220

Val Ala Thr Ile Thr Leu Asp Leu Thr Lys His Ser Leu Asp Arg Tyr
225                 230                 235                 240

Val Gly Asn Tyr Ser Arg Phe Val Glu Leu Lys Glu Gln Lys Leu Val
                245                 250                 255

Thr Glu Ala Lys Asn Tyr Glu Lys Gln Gln Lys Glu Ile Ala Ala Leu
            260                 265                 270

Glu Asp Phe Val Asn Arg Asn Leu Val Arg Ala Ser Thr Thr Lys Arg
        275                 280                 285

Ala Gln Ser Arg Arg Lys Gln Leu Glu Lys Met Glu Arg Leu Asp Lys
    290                 295                 300

Pro Glu Ala Gly Lys Lys Ala Ala Asn Met Thr Phe Gln Ser Glu Lys
305                 310                 315                 320

Thr Ser Gly Asn Val Val Leu Thr Val Glu Asn Ala Ala Val Gly Tyr
                325                 330                 335

Asp Gly Glu Val Leu Ser Gln Pro Ile Asn Leu Asp Leu Arg Lys Met
            340                 345                 350
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Asn Ala Val Ala Ile Val Gly Pro Asn Gly Ile Gly Lys Ser Thr Phe
        355                 360                 365

Ile Lys Ser Ile Val Asp Gln Ile Pro Phe Ile Lys Gly Glu Lys Arg
    370                 375                 380

Phe Gly Ala Asn Val Glu Val Gly Tyr Tyr Asp Gln Thr Gln Ser Lys
385                 390                 395                 400

Leu Thr Pro Ser Asn Thr Val Leu Asp Glu Leu Trp Asn Asp Phe Lys
                405                 410                 415

Leu Thr Pro Glu Val Glu Ile Arg Asn Arg Leu Gly Ala Phe Leu Phe
            420                 425                 430

Ser Gly Asp Asp Val Lys Lys Ser Val Gly Met Leu Ser Gly Gly Glu
        435                 440                 445

Lys Ala Arg Leu Leu Leu Ala Lys Leu Ser Met Glu Asn Asn Asn Phe
    450                 455                 460

Leu Ile Leu Asp Glu Pro Thr Asn His Leu Asp Ile Asp Ser Lys Glu
465                 470                 475                 480

Val Leu Glu Asn Ala Leu Ile Asp Phe Asp Gly Thr Leu Leu Phe Val
                485                 490                 495

Ser His Asp Arg Tyr Phe Ile Asn Arg Val Ala Thr His Val Leu Glu
            500                 505                 510

Leu Ser Glu Asn Gly Ser Thr Leu Tyr Leu Gly Asp Tyr Asp Tyr Tyr
        515                 520                 525

Val Glu Lys Lys Ala Thr Ala Glu Met Ser Gln Thr Glu Glu Ala Ser
    530                 535                 540

Thr Ser Asn Gln Ala Lys Glu Ala Ser Pro Val Asn Asp Tyr Gln Ala
545                 550                 555                 560

Gln Lys Glu Ser Gln Lys Glu Val Arg Lys Leu Met Arg Gln Ile Glu
                565                 570                 575

Ser Leu Glu Ala Glu Ile Glu Glu Leu Glu Ser Gln Ser Gln Ala Ile
            580                 585                 590

Ser Glu Gln Met Leu Glu Thr Asn Asp Ala Asp Lys Leu Met Glu Leu
        595                 600                 605

Gln Ala Glu Leu Asp Lys Ile Ser His Arg Gln Glu Glu Ala Met Leu
    610                 615                 620

Glu Trp Glu Glu Leu Ser Glu Gln Val
625                 630
```

<210> 119
<211> 1179
<212> DNA
<213> Streptococcus pneumoniae

<400> 119
atgaatcgct atgcagtgca gttgattagc cgtggggcta tcaataaaat gggaaatatg 60
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ttaggaatgt atcagatttc tgagctcgtc acatctattc tcgtcaatcc ctttggcgga 180
gttatttcag accgtttttc tcgtcgtaag attttaatga cggcagatct tgtttgtggg 240
attctttgtc tggctatttc tttcataagg aatgatagct ggatgattgg cgctttgatt 300
gttgctaaca ttgtgcaggc tattgctttt gccttttctc gcacagccaa taaagctatc 360
ataactgaag tggtggagaa agatgagatt gtgatctata attctcgctt agagctggtt 420
ttgcaggttg taggtgttag ctctcctgtt ctttccttcc ttgttttaca gtttgcaagt 480
ctccatatga cgctactgct agactcgctg actttttttca ttgcttttgt tctagtggct 540
ttccttccaa aagaggaagc aaaagttcaa gagaaaaagg cttttactgg gagagatatt 600
tttgtagata tcaaggatgg gttacactat atctggcatc agcaagaaat tttcttcctt 660
ttgctggtag cttccagcgt taatttcttt tttgcagctt ttgaatttct acttcccttt 720
tcgaatcagc tttacgggtc agaaggagcc tatgcaagta ttttaactat gggggctatt 780
ggttccatca ttggggctct tctagctagt aaaattaaag ctaatattta taatcttttg 840
attttactgg ctttgacagg tgtcggagtt tttatgatgg gattaccact tccaactttt 900
ctttcctttt ctggaaattt agtttgtgaa ttgtttatga cgatttttaa tattcacttt 960
tttactcaag tacaaaccaa ggttgagagc gaatttcttg gaagagtact gagtacaatt 1020
tttaccttag ctattctatt tatgcctatt gcaaaaggat ttatgacagt cttgccaagt 1080
gtccatcttt attctttctt gattattgga cttggagttg tagccttata tttcttagct 1140
ctcggatatg ttcgaactca ttttgaaaaa ttgatataa 1179

<210> 120
<211> 392
<212> PRT
<213> Streptococcus pneumoniae

<400> 120
Met Asn Arg Tyr Ala Val Gln Leu Ile Ser Arg Gly Ala Ile Asn Lys
1 5 10 15

Met Gly Asn Met Leu Tyr Asp Tyr Gly Asn Ser Val Trp Leu Ala Ser
20 25 30

Met Gly Thr Ile Gly Gln Thr Val Leu Gly Met Tyr Gln Ile Ser Glu
35 40 45

Leu Val Thr Ser Ile Leu Val Asn Pro Phe Gly Gly Val Ile Ser Asp
50 55 60

Arg Phe Ser Arg Arg Lys Ile Leu Met Thr Ala Asp Leu Val Cys Gly
65 70 75 80

Ile Leu Cys Leu Ala Ile Ser Phe Ile Arg Asn Asp Ser Trp Met Ile
85 90 95

Gly Ala Leu Ile Val Ala Asn Ile Val Gln Ala Ile Ala Phe Ala Phe
100 105 110

Ser Arg Thr Ala Asn Lys Ala Ile Ile Thr Glu Val Val Glu Lys Asp
115 120 125

```
Glu Ile Val Ile Tyr Asn Ser Arg Leu Glu Leu Val Leu Gln Val Val
    130                 135                 140

Gly Val Ser Ser Pro Val Leu Ser Phe Leu Val Leu Gln Phe Ala Ser
145                 150                 155                 160

Leu His Met Thr Leu Leu Leu Asp Ser Leu Thr Phe Phe Ile Ala Phe
                165                 170                 175

Val Leu Val Ala Phe Leu Pro Lys Glu Glu Ala Lys Val Gln Glu Lys
            180                 185                 190

Lys Ala Phe Thr Gly Arg Asp Ile Phe Val Asp Ile Lys Asp Gly Leu
        195                 200                 205

His Tyr Ile Trp His Gln Gln Glu Ile Phe Phe Leu Leu Leu Val Ala
    210                 215                 220

Ser Ser Val Asn Phe Phe Phe Ala Ala Phe Glu Phe Leu Leu Pro Phe
225                 230                 235                 240

Ser Asn Gln Leu Tyr Gly Ser Glu Gly Ala Tyr Ala Ser Ile Leu Thr
                245                 250                 255

Met Gly Ala Ile Gly Ser Ile Ile Gly Ala Leu Leu Ala Ser Lys Ile
            260                 265                 270

Lys Ala Asn Ile Tyr Asn Leu Leu Ile Leu Leu Ala Leu Thr Gly Val
        275                 280                 285

Gly Val Phe Met Met Gly Leu Pro Leu Pro Thr Phe Leu Ser Phe Ser
    290                 295                 300

Gly Asn Leu Val Cys Glu Leu Phe Met Thr Ile Phe Asn Ile His Phe
305                 310                 315                 320

Phe Thr Gln Val Gln Thr Lys Val Glu Ser Glu Phe Leu Gly Arg Val
                325                 330                 335

Leu Ser Thr Ile Phe Thr Leu Ala Ile Leu Phe Met Pro Ile Ala Lys
            340                 345                 350

Gly Phe Met Thr Val Leu Pro Ser Val His Leu Tyr Ser Phe Leu Ile
        355                 360                 365

Ile Gly Leu Gly Val Val Ala Leu Tyr Phe Leu Ala Leu Gly Tyr Val
    370                 375                 380

Arg Thr His Phe Glu Lys Leu Ile
385                 390
```

<210> 121
<211> 2466
<212> DNA

<213> Streptococcus pneumoniae

<400> 121
atgcaaaatc aattaaatga attaaaacga aaaatgctgg aatttttcca gcaaaaacaa 60
aaaaataaaa aatcagctag acctggcaag aaaggttcaa gtaccaaaaa atctaaaacc 120
ttagataagt cagccatttt cccagctatt ttactgagta taaaagcctt atttaactta 180
ctctttgtac tcggttttct aggaggaatg ttgggagctg ggattgcttt gggatacgga 240
gtggccttat ttgacaaggt tcgggtgcct cagacagaag aattggtgaa tcaggtcaag 300
gacatctctt ctatttcaga gattacctat tcggacggga cggtgattgc ttccatagag 360
agtgatttgt tgcgcacttc tatctcatct gagcaaattt cggaaaatct gaagaaggct 420
atcattgcga cagaagatga acactttaaa gaacataagg gtgtagtacc caaggcggtg 480
attcgtgcga ccttggggaa atttgtaggt ttgggttcct ctagtggggg ttcaaccttg 540
acccagcaac taattaaaca gcaggtggtt ggggatgcgc cgaccttggc tcgtaaggcg 600
gcagagattg tggatgctct tgccttggaa cgcgccatga ataaagatga gattttaacg 660
acctatctca atgtggctcc ctttggccga aataataagg gacagaatat tgcaggggct 720
cggcaagcag ctgagggaat tttcggtgta gatgccagtc agttgactgt tcctcaagca 780
gcatttttag caggacttcc acagagtccc attacttact ctccttatga aaatactggg 840
gagttgaaga gtgatgaaga cctagaaatt ggcttaagac gggctaaggc agttctttac 900
agtatgtatc gtacaggtgc attaagcaaa gacgagtatt ctcagtacaa ggattatgac 960
cttaaacagg acttttacc atcgggcacg gttacaggaa tttcacgaga ctatttatac 1020
tttacaactt tggcagaagc tcaagaacgt atgtatgact atctagctca gagagacaat 1080
gtctccgcta aggagttgaa aaatgaggca actcagaagt tttatcgaga tttggcagcc 1140
aaggaaattg aaaatggtgg ttataagatt actactacca tagatcagaa aattcattct 1200
gccatgcaaa gtgcggttgc tgattatggc tatcttttag acgatggaac aggtcgtgta 1260
gaagtaggga atgtcttgat ggataaccaa acaggtgcta ttctaggctt tgtaggtggt 1320
cgtaattatc aagaaaatca aaataatcat gcctttgata ccaaacgttc gccagcttct 1380
actaccaagc ccttgctggc ctacggtatt gctattgacc agggcttgat gggaagtgaa 1440
acgattctat ctaactatcc aacaaacttt gctaatggca atccgattat gtatgctaat 1500
agcaagggaa caggaatgat gaccttggga gaagctctga actattcatg gaatatccct 1560
gcttactgga cctatcgtat gctccgtgaa aagggtgttg atgtcaaggg ttatatggaa 1620
aagatgggtt acgagattcc tgagtacggt attgagagct tgccaatggg tggtggtatt 1680
gaagtcacag ttgcccagca taccaatggc tatcagacct tagctaataa tggagtttat 1740
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caggataaac cggttcaagt ctattcaaaa gctactgcga cgattatgca gggattgcta 1860
cgagaagttc tatcctctcg tgtgacaaca accttcaagt ctaacctgac ttctttaaat 1920
cctactctgg ctaatgcaga ttggattggg aagactggta caaccaacca agacgaaaat 1980
atgtggctca tgctttcgac acctagatta accctaggtg gctggattgg gcatgatgat 2040
aatcattcat tgtcacgtag agcaggttat tctaataact ctaattacat ggctcatctg 2100
gtaaatgcga ttcagcaagc ttccccaagc atttgggggа acgagcgctt tgctttagat 2160
cctagtgtag tgaaatcgga agtcttgaaa tcaacaggtc aaaaaccaga gaaggtttct 2220
gttgaaggaa aagaagtaga ggtcacaggt tcgactgtta ccagctattg ggctaataag 2280
tcaggagcgc cagcgacaag ttatcgcttt gctattggcg gaagtgatgc ggattatcag 2340
aatgcttggt ctagtattgt ggggagtcta ccaactccat ccagctccag cagttcaagt 2400
agtagttcta gcgatagcag taactcaagt actacacgac cttcttcttc aagggcgaga 2460
cgataa 2466

<210> 122
<211> 821
<212> PRT
<213> Streptococcus pneumoniae

<400> 122
Met Gln Asn Gln Leu Asn Glu Leu Lys Arg Lys Met Leu Glu Phe Phe
1 5 10 15

Gln Gln Lys Gln Lys Asn Lys Lys Ser Ala Arg Pro Gly Lys Lys Gly

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            20                  25                  30

Ser Ser Thr Lys Lys Ser Lys Thr Leu Asp Lys Ser Ala Ile Phe Pro
         35                  40                  45

Ala Ile Leu Leu Ser Ile Lys Ala Leu Phe Asn Leu Leu Phe Val Leu
     50                  55                  60

Gly Phe Leu Gly Gly Met Leu Gly Ala Gly Ile Ala Leu Gly Tyr Gly
 65                  70                  75                  80

Val Ala Leu Phe Asp Lys Val Arg Val Pro Gln Thr Glu Glu Leu Val
                 85                  90                  95

Asn Gln Val Lys Asp Ile Ser Ser Ile Ser Glu Ile Thr Tyr Ser Asp
            100                 105                 110

Gly Thr Val Ile Ala Ser Ile Glu Ser Asp Leu Leu Arg Thr Ser Ile
        115                 120                 125

Ser Ser Glu Gln Ile Ser Glu Asn Leu Lys Lys Ala Ile Ile Ala Thr
    130                 135                 140

Glu Asp Glu His Phe Lys Glu His Lys Gly Val Val Pro Lys Ala Val
145                 150                 155                 160

Ile Arg Ala Thr Leu Gly Lys Phe Val Gly Leu Gly Ser Ser Ser Gly
                165                 170                 175

Gly Ser Thr Leu Thr Gln Gln Leu Ile Lys Gln Gln Val Val Gly Asp
            180                 185                 190

Ala Pro Thr Leu Ala Arg Lys Ala Ala Glu Ile Val Asp Ala Leu Ala
        195                 200                 205

Leu Glu Arg Ala Met Asn Lys Asp Glu Ile Leu Thr Thr Tyr Leu Asn
    210                 215                 220

Val Ala Pro Phe Gly Arg Asn Asn Lys Gly Gln Asn Ile Ala Gly Ala
225                 230                 235                 240

Arg Gln Ala Ala Glu Gly Ile Phe Gly Val Asp Ala Ser Gln Leu Thr
                245                 250                 255

Val Pro Gln Ala Ala Phe Leu Ala Gly Leu Pro Gln Ser Pro Ile Thr
            260                 265                 270

Tyr Ser Pro Tyr Glu Asn Thr Gly Glu Leu Lys Ser Asp Glu Asp Leu
        275                 280                 285

Glu Ile Gly Leu Arg Arg Ala Lys Ala Val Leu Tyr Ser Met Tyr Arg
    290                 295                 300

Thr Gly Ala Leu Ser Lys Asp Glu Tyr Ser Gln Tyr Lys Asp Tyr Asp
305                 310                 315                 320

Leu Lys Gln Asp Phe Leu Pro Ser Gly Thr Val Thr Gly Ile Ser Arg
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                325                 330                 335

Asp Tyr Leu Tyr Phe Thr Thr Leu Ala Glu Ala Gln Glu Arg Met Tyr
            340                 345                 350

Asp Tyr Leu Ala Gln Arg Asp Asn Val Ser Ala Lys Glu Leu Lys Asn
        355                 360                 365

Glu Ala Thr Gln Lys Phe Tyr Arg Asp Leu Ala Ala Lys Glu Ile Glu
    370                 375                 380

Asn Gly Gly Tyr Lys Ile Thr Thr Thr Ile Asp Gln Lys Ile His Ser
385                 390                 395                 400

Ala Met Gln Ser Ala Val Ala Asp Tyr Gly Tyr Leu Leu Asp Asp Gly
                405                 410                 415

Thr Gly Arg Val Glu Val Gly Asn Val Leu Met Asp Asn Gln Thr Gly
            420                 425                 430

Ala Ile Leu Gly Phe Val Gly Gly Arg Asn Tyr Gln Glu Asn Gln Asn
        435                 440                 445

Asn His Ala Phe Asp Thr Lys Arg Ser Pro Ala Ser Thr Thr Lys Pro
    450                 455                 460

Leu Leu Ala Tyr Gly Ile Ala Ile Asp Gln Gly Leu Met Gly Ser Glu
465                 470                 475                 480

Thr Ile Leu Ser Asn Tyr Pro Thr Asn Phe Ala Asn Gly Asn Pro Ile
                485                 490                 495

Met Tyr Ala Asn Ser Lys Gly Thr Gly Met Met Thr Leu Gly Glu Ala
            500                 505                 510

Leu Asn Tyr Ser Trp Asn Ile Pro Ala Tyr Trp Thr Tyr Arg Met Leu
        515                 520                 525

Arg Glu Lys Gly Val Asp Val Lys Gly Tyr Met Glu Lys Met Gly Tyr
    530                 535                 540

Glu Ile Pro Glu Tyr Gly Ile Glu Ser Leu Pro Met Gly Gly Gly Ile
545                 550                 555                 560

Glu Val Thr Val Ala Gln His Thr Asn Gly Tyr Gln Thr Leu Ala Asn
                565                 570                 575

Asn Gly Val Tyr His Gln Lys His Val Ile Ser Lys Ile Glu Ala Ala
            580                 585                 590

Asp Gly Arg Val Val Tyr Glu Tyr Gln Asp Lys Pro Val Gln Val Tyr
        595                 600                 605

Ser Lys Ala Thr Ala Thr Ile Met Gln Gly Leu Leu Arg Glu Val Leu
    610                 615                 620

Ser Ser Arg Val Thr Thr Thr Phe Lys Ser Asn Leu Thr Ser Leu Asn
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625 630 635 640

Pro Thr Leu Ala Asn Ala Asp Trp Ile Gly Lys Thr Gly Thr Thr Asn
645 650 655

Gln Asp Glu Asn Met Trp Leu Met Leu Ser Thr Pro Arg Leu Thr Leu
660 665 670

Gly Gly Trp Ile Gly His Asp Asp Asn His Ser Leu Ser Arg Arg Ala
675 680 685

Gly Tyr Ser Asn Asn Ser Asn Tyr Met Ala His Leu Val Asn Ala Ile
690 695 700

Gln Gln Ala Ser Pro Ser Ile Trp Gly Asn Glu Arg Phe Ala Leu Asp
705 710 715 720

Pro Ser Val Val Lys Ser Glu Val Leu Lys Ser Thr Gly Gln Lys Pro
725 730 735

Glu Lys Val Ser Val Glu Gly Lys Glu Val Glu Val Thr Gly Ser Thr
740 745 750

Val Thr Ser Tyr Trp Ala Asn Lys Ser Gly Ala Pro Ala Thr Ser Tyr
755 760 765

Arg Phe Ala Ile Gly Gly Ser Asp Ala Asp Tyr Gln Asn Ala Trp Ser
770 775 780

Ser Ile Val Gly Ser Leu Pro Thr Pro Ser Ser Ser Ser Ser Ser Ser
785 790 795 800

Ser Ser Ser Ser Asp Ser Ser Asn Ser Ser Thr Thr Arg Pro Ser Ser
805 810 815

Ser Arg Ala Arg Arg
820

<210> 123
<211> 1974
<212> DNA
<213> Streptococcus pneumoniae

<400> 123
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gtcttatcca ctttcattat ttttgttaat aataatctgt tgacggtttt aattttgttt 120
ctttttgtag gaggctatgt ttttttattt aagaaactga gagtgcatta tacaaggagt 180
gatgtagaac agatacagta tgtaaaccac caagcggaag aaagtttgac agctctattg 240
gaacagatgc ctgtaggtgt tatgaaattg aatttatctt ctggagaggt tgagtggttt 300
aatccctatg ctgaattgat tttgaccaag gaagatggtg attttgattt agaagctgtt 360
caaacgatta tcaaggcttc agtaggaaat ccgtctactt atgccaagct tggtgagaag 420
cgttatgctg ttcatatgga tgcttcttcc ggtgttttgt attttgtaga tgtatccagg 480
gaacaagcca taacagatga attggtaaca agtagaccag tgattgggat tgtctctgtg 540
gataattatg atgatttgga ggatgaaact tctgagtcag atattagtca aatcaatagt 600
tttgtagcta attttatatc agagttttca gaaaaacaca tgatgttttc tcgtcgggta 660

agtatggatc gattttatct atttactgac tacacggtgc ttgagggctt gatgaatgat 720
aaattttctg ttattgatgc tttcagagaa gagtcgaaac agagacagtt gcccttgacc 780
ttaagtatgg gattttctta tggcgatgga aatcatgatg agatagggaa agttgctttg 840
ctcaatttga acttggctga agtacgtggt ggcgaccagg tggttgttaa ggaaaacgac 900
gaaacgaaaa atccagttta ttttggtggt gggtctgctg cttcaatcaa gcgtacacgg 960
actcgtacgc gcgctatgat gacagctatt tcagataaga ttcggagtgt agatcaggtt 1020
tttgtagtcg gtcacaaaaa tttagacatg gatgctttgg gctctgctgt aggtatgcag 1080
ttgttcgcca gcaatgtgat tgaaaatagc tatgctcttt atgatgaaga acaaatgtct 1140
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gttaaggatg caatggggat ggtgaccaat cgttctttgt tgattcttgt agaccattca 1260
aagacagcct taacattatc aaaagaattt tatgatttat ttacccaaac cattgttatt 1320
gaccaccata gaagggatca ggattttcca gataatgcgg ttattactta tatcgaaagt 1380
ggtgcaagta gtgccagtga gttggtaacg gaattgattc agttccagaa ttctaagaaa 1440
aatcgtttga gtcgtatgca agcaagtgtc ttgatggctg gtatgatgtt ggatactaaa 1500
aatttcacct cgcgagtaac tagtcggaca tttgatgttg ctagctatct cagaacgcgc 1560
ggaagtgata gtattgctat ccaggaaatc gctgcgacag attttgaaga atatcgtgag 1620
gtcaatgaac ttattttaca ggggcgtaaa ttaggttcag atgtactaat agcagaggct 1680
aaggacatga aatgctatga tacagttgtt attagtaagg cagcagatgc catgttagcc 1740
atgtcaggta ttgaagcgag ttttgttctt gcgaagaata cacaaggatt tatctctatc 1800
tcagctcgaa gtcgtagtaa actgaatgta caacggatta tggaagagtt aggcggtgga 1860
ggccacttta atttggcagc agctcaaatt aaagatgtaa ccttgtcaga agcaggtgaa 1920
aaactgacag aaattgtatt aaatgaaatg aaggaaaagg agaaagaaga atga 1974

<210> 124
<211> 657
<212> PRT
<213> Streptococcus pneumoniae

<400> 124
Met Lys Lys Phe Tyr Val Ser Pro Ile Phe Pro Ile Leu Val Gly Leu
1 5 10 15

Ile Ala Phe Gly Val Leu Ser Thr Phe Ile Ile Phe Val Asn Asn Asn
20 25 30

Leu Leu Thr Val Leu Ile Leu Phe Leu Phe Val Gly Gly Tyr Val Phe
35 40 45

Leu Phe Lys Lys Leu Arg Val His Tyr Thr Arg Ser Asp Val Glu Gln
50 55 60

Ile Gln Tyr Val Asn His Gln Ala Glu Glu Ser Leu Thr Ala Leu Leu
65 70 75 80

Glu Gln Met Pro Val Gly Val Met Lys Leu Asn Leu Ser Ser Gly Glu
85 90 95

Val Glu Trp Phe Asn Pro Tyr Ala Glu Leu Ile Leu Thr Lys Glu Asp
100 105 110

Gly Asp Phe Asp Leu Glu Ala Val Gln Thr Ile Ile Lys Ala Ser Val
115 120 125

Gly Asn Pro Ser Thr Tyr Ala Lys Leu Gly Glu Lys Arg Tyr Ala Val
130 135 140

```
His Met Asp Ala Ser Ser Gly Val Leu Tyr Phe Val Asp Val Ser Arg
145                 150                 155                 160

Glu Gln Ala Ile Thr Asp Glu Leu Val Thr Ser Arg Pro Val Ile Gly
                165                 170                 175

Ile Val Ser Val Asp Asn Tyr Asp Asp Leu Glu Asp Glu Thr Ser Glu
            180                 185                 190

Ser Asp Ile Ser Gln Ile Asn Ser Phe Val Ala Asn Phe Ile Ser Glu
        195                 200                 205

Phe Ser Glu Lys His Met Met Phe Ser Arg Arg Val Ser Met Asp Arg
    210                 215                 220

Phe Tyr Leu Phe Thr Asp Tyr Thr Val Leu Glu Gly Leu Met Asn Asp
225                 230                 235                 240

Lys Phe Ser Val Ile Asp Ala Phe Arg Glu Glu Ser Lys Gln Arg Gln
                245                 250                 255

Leu Pro Leu Thr Leu Ser Met Gly Phe Ser Tyr Gly Asp Gly Asn His
            260                 265                 270

Asp Glu Ile Gly Lys Val Ala Leu Leu Asn Leu Asn Leu Ala Glu Val
        275                 280                 285

Arg Gly Gly Asp Gln Val Val Val Lys Glu Asn Asp Glu Thr Lys Asn
    290                 295                 300

Pro Val Tyr Phe Gly Gly Gly Ser Ala Ala Ser Ile Lys Arg Thr Arg
305                 310                 315                 320

Thr Arg Thr Arg Ala Met Met Thr Ala Ile Ser Asp Lys Ile Arg Ser
                325                 330                 335

Val Asp Gln Val Phe Val Val Gly His Lys Asn Leu Asp Met Asp Ala
            340                 345                 350

Leu Gly Ser Ala Val Gly Met Gln Leu Phe Ala Ser Asn Val Ile Glu
        355                 360                 365

Asn Ser Tyr Ala Leu Tyr Asp Glu Glu Gln Met Ser Pro Asp Ile Glu
    370                 375                 380

Arg Ala Val Ser Phe Ile Glu Lys Glu Gly Val Thr Lys Leu Leu Ser
385                 390                 395                 400

Val Lys Asp Ala Met Gly Met Val Thr Asn Arg Ser Leu Leu Ile Leu
                405                 410                 415

Val Asp His Ser Lys Thr Ala Leu Thr Leu Ser Lys Glu Phe Tyr Asp
            420                 425                 430

Leu Phe Thr Gln Thr Ile Val Ile Asp His His Arg Arg Asp Gln Asp
        435                 440                 445
```

```
Phe Pro Asp Asn Ala Val Ile Thr Tyr Ile Glu Ser Gly Ala Ser Ser
    450                 455                 460

Ala Ser Glu Leu Val Thr Glu Leu Ile Gln Phe Gln Asn Ser Lys Lys
465                 470                 475                 480

Asn Arg Leu Ser Arg Met Gln Ala Ser Val Leu Met Ala Gly Met Met
                485                 490                 495

Leu Asp Thr Lys Asn Phe Thr Ser Arg Val Thr Ser Arg Thr Phe Asp
            500                 505                 510

Val Ala Ser Tyr Leu Arg Thr Arg Gly Ser Asp Ser Ile Ala Ile Gln
        515                 520                 525

Glu Ile Ala Ala Thr Asp Phe Glu Glu Tyr Arg Glu Val Asn Glu Leu
    530                 535                 540

Ile Leu Gln Gly Arg Lys Leu Gly Ser Asp Val Leu Ile Ala Glu Ala
545                 550                 555                 560

Lys Asp Met Lys Cys Tyr Asp Thr Val Val Ile Ser Lys Ala Ala Asp
                565                 570                 575

Ala Met Leu Ala Met Ser Gly Ile Glu Ala Ser Phe Val Leu Ala Lys
            580                 585                 590

Asn Thr Gln Gly Phe Ile Ser Ile Ser Ala Arg Ser Arg Ser Lys Leu
        595                 600                 605

Asn Val Gln Arg Ile Met Glu Glu Leu Gly Gly Gly Gly His Phe Asn
    610                 615                 620

Leu Ala Ala Ala Gln Ile Lys Asp Val Thr Leu Ser Glu Ala Gly Glu
625                 630                 635                 640

Lys Leu Thr Glu Ile Val Leu Asn Glu Met Lys Glu Lys Glu Lys Glu
                645                 650                 655

Glu
```

<210> 125
<211> 663
<212> DNA
<213> Streptococcus pneumoniae

<400> 125
atgaagtgct tgttatgtgg gcagactatg aagactgttt taacttttag tagtctctta 60
cttctgagga atgatgactc ttgtctttgt tcagactgtg attctacttt tgaaagaatt 120
ggggaagaga actgtccaaa ttgtatgaaa acagagttgt caacaaagtg tcaagattgt 180
caactttggt gtaaagaggg agttgaagtc agtcatagag cgatttttac ttacaatcaa 240
gctatgaagg atttttcag tcggtataag tttgatggag acttcctgtt aagaaaagtt 300
ttcgcttcat ttttaagtga ggagttgaaa aagtacaaag agtatcaatt tgttgtaatt 360
cccctaagtc ctgatagata tgctaataga ggatttaatc aggttgaggg cttggtagag 420

gcagcaggct ttgagtatct ggatttatta gagaaaagag aagagagagc cagttcttct 480
aaaaatcgtt cagagcgctt ggggacagaa cttcctttct ttattaaaag tggagtcact 540
attcctaaaa aaatcctact tatagatgat atctatacta caggagcaac tataaatcgt 600
gttaagaaac tgttggaaga agctggtgct aaggatgtaa aaacattttc ccttgtaaga 660
tga 663

<210> 126
<211> 220
<212> PRT
<213> Streptococcus pneumoniae

<400> 126

```
Met Lys Cys Leu Leu Cys Gly Gln Thr Met Lys Thr Val Leu Thr Phe
  1               5                  10                  15

Ser Ser Leu Leu Leu Leu Arg Asn Asp Asp Ser Cys Leu Cys Ser Asp
             20                  25                  30

Cys Asp Ser Thr Phe Glu Arg Ile Gly Glu Glu Asn Cys Pro Asn Cys
         35                  40                  45

Met Lys Thr Glu Leu Ser Thr Lys Cys Gln Asp Cys Gln Leu Trp Cys
     50                  55                  60

Lys Glu Gly Val Glu Val Ser His Arg Ala Ile Phe Thr Tyr Asn Gln
 65                  70                  75                  80

Ala Met Lys Asp Phe Phe Ser Arg Tyr Lys Phe Asp Gly Asp Phe Leu
                 85                  90                  95

Leu Arg Lys Val Phe Ala Ser Phe Leu Ser Glu Glu Leu Lys Lys Tyr
            100                 105                 110

Lys Glu Tyr Gln Phe Val Val Ile Pro Leu Ser Pro Asp Arg Tyr Ala
        115                 120                 125

Asn Arg Gly Phe Asn Gln Val Glu Gly Leu Val Glu Ala Ala Gly Phe
    130                 135                 140

Glu Tyr Leu Asp Leu Leu Glu Lys Arg Glu Glu Arg Ala Ser Ser Ser
145                 150                 155                 160

Lys Asn Arg Ser Glu Arg Leu Gly Thr Glu Leu Pro Phe Phe Ile Lys
                165                 170                 175

Ser Gly Val Thr Ile Pro Lys Lys Ile Leu Leu Ile Asp Asp Ile Tyr
            180                 185                 190

Thr Thr Gly Ala Thr Ile Asn Arg Val Lys Lys Leu Leu Glu Glu Ala
        195                 200                 205

Gly Ala Lys Asp Val Lys Thr Phe Ser Leu Val Arg
    210                 215                 220
```

<210> 127
<211> 1299
<212> DNA
<213> Streptococcus pneumoniae

<400> 127
atgaaagtaa atttagatta tctcggtcgt ttatttactg agaatgaatt aacagaagaa 60
gaacgtcagt tggcggagaa acttccagca atgagaaagg agaaggggaa acttttctgt 120
caacgctgta atagtactat tctagaagaa tggtatttgc ccatcggtgc ttactattgt 180
cgagagtgct tgctgatgaa gcgagtcaga agtgatcaaa ctttatacta ttttccgcag 240
gaggattttc caaagcaaga tgttctcaaa tggcgcggcc aattaactcc ttttcaagag 300
aaggtgtcag agggattgct tcaagtagta gacaagcaaa agccaacctt agttcatgcg 360
gtaacaggag ctggaaagac agaaatgatt tatcaagtag tggctaaagt gatcaatgcg 420
ggtggtgcag tgtgtttggc tagtcctcgc atagatgttt gtttggagct gtacaagcgc 480
ctgcaacagg atttttcttg cgggatagct ttgctacatg gagaatcgga accttatttt 540
cgaacaccac tagttgttgc aacaacccat cagttattga agttttatca agcttttgat 600
ttgctgatag tggatgaagt agatgctttt ccttatgttg ataatcccat gctttaccac 660
gctgtcaaga atagtgtaaa ggagaatgga ttgagaatct ttttaacagc gacttcgacc 720
aatgagttag ataaaaaggt ccgtttagga gaactaaaaa gactgaattt accgagacgg 780
tttcatggaa atccgttgat tattccaaaa ccaatttggt tatcggattt taatcgctac 840
ttagacaaga atcgtttgtc accaaagtta aagtcctata ttgagaagca gagaaagaca 900
gcttatccgt tactcatttt tgcttcagaa attaagaaag gggagcagtt agcagaaatc 960
ttacaggagc aatttccaaa tgagaaaatt ggctttgtat cttctgtaac agaggatcga 1020
ttagagcaag tacaagcttt tcgagatgga gaactgacaa tacttatcag tacgacaatc 1080
ttggagcgcg gagttacctt cccttgtgtg gatgttttcg tagtagaggc caatcatcgt 1140
ttgtttacca agtctagttt gattcagatt ggtggacgag ttggacgaag catggataga 1200
ccgacaggag atttgctttt cttccatgat gggttaaatg cttcaatcaa gaaggcgatt 1260
aaggaaattc agatgatgaa taaggaggct ggtctatga 1299

<210> 128
<211> 432
<212> PRT
<213> Streptococcus pneumoniae

<400> 128
Met Lys Val Asn Leu Asp Tyr Leu Gly Arg Leu Phe Thr Glu Asn Glu
1 5 10 15

Leu Thr Glu Glu Glu Arg Gln Leu Ala Glu Lys Leu Pro Ala Met Arg
20 25 30

Lys Glu Lys Gly Lys Leu Phe Cys Gln Arg Cys Asn Ser Thr Ile Leu
35 40 45

Glu Glu Trp Tyr Leu Pro Ile Gly Ala Tyr Tyr Cys Arg Glu Cys Leu
50 55 60

Leu Met Lys Arg Val Arg Ser Asp Gln Thr Leu Tyr Tyr Phe Pro Gln
65 70 75 80

Glu Asp Phe Pro Lys Gln Asp Val Leu Lys Trp Arg Gly Gln Leu Thr
85 90 95

Pro Phe Gln Glu Lys Val Ser Glu Gly Leu Leu Gln Val Val Asp Lys
100 105 110

```
Gln Lys Pro Thr Leu Val His Ala Val Thr Gly Ala Gly Lys Thr Glu
        115                 120                 125

Met Ile Tyr Gln Val Val Ala Lys Val Ile Asn Ala Gly Gly Ala Val
    130                 135                 140

Cys Leu Ala Ser Pro Arg Ile Asp Val Cys Leu Glu Leu Tyr Lys Arg
145                 150                 155                 160

Leu Gln Gln Asp Phe Ser Cys Gly Ile Ala Leu Leu His Gly Glu Ser
                165                 170                 175

Glu Pro Tyr Phe Arg Thr Pro Leu Val Val Ala Thr Thr His Gln Leu
            180                 185                 190

Leu Lys Phe Tyr Gln Ala Phe Asp Leu Leu Ile Val Asp Glu Val Asp
        195                 200                 205

Ala Phe Pro Tyr Val Asp Asn Pro Met Leu Tyr His Ala Val Lys Asn
    210                 215                 220

Ser Val Lys Glu Asn Gly Leu Arg Ile Phe Leu Thr Ala Thr Ser Thr
225                 230                 235                 240

Asn Glu Leu Asp Lys Lys Val Arg Leu Gly Glu Leu Lys Arg Leu Asn
                245                 250                 255

Leu Pro Arg Arg Phe His Gly Asn Pro Leu Ile Ile Pro Lys Pro Ile
            260                 265                 270

Trp Leu Ser Asp Phe Asn Arg Tyr Leu Asp Lys Asn Arg Leu Ser Pro
        275                 280                 285

Lys Leu Lys Ser Tyr Ile Glu Lys Gln Arg Lys Thr Ala Tyr Pro Leu
    290                 295                 300

Leu Ile Phe Ala Ser Glu Ile Lys Lys Gly Glu Gln Leu Ala Glu Ile
305                 310                 315                 320

Leu Gln Glu Gln Phe Pro Asn Glu Lys Ile Gly Phe Val Ser Ser Val
                325                 330                 335

Thr Glu Asp Arg Leu Glu Gln Val Gln Ala Phe Arg Asp Gly Glu Leu
            340                 345                 350

Thr Ile Leu Ile Ser Thr Thr Ile Leu Glu Arg Gly Val Thr Phe Pro
        355                 360                 365

Cys Val Asp Val Phe Val Val Glu Ala Asn His Arg Leu Phe Thr Lys
    370                 375                 380

Ser Ser Leu Ile Gln Ile Gly Gly Arg Val Gly Arg Ser Met Asp Arg
385                 390                 395                 400

Pro Thr Gly Asp Leu Leu Phe Phe His Asp Gly Leu Asn Ala Ser Ile
                405                 410                 415
```

```
Lys Lys Ala Ile Lys Glu Ile Gln Met Met Asn Lys Glu Ala Gly Leu
            420                 425                 430
```

<210> 129
<211> 870
<212> DNA
<213> Streptococcus pneumoniae

<400> 129
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atgcaaattc aaaaaagttt taaggggcag tctccctatg gcaagctgta tctagtggca 60
acgccgattg gcaatctaga tgatatgact tttcgtgcta tccagacctt gaaagaagtg 120
gactggattg ctgctgagga tacgcgcaat acagggcttt tgctcaagca ttttgacatt 180
tccaccaagc agatcagttt tcatgagcac aatgccaagg aaaaaattcc tgatttgatt 240
ggtttcttga aagcagggca aagtattgct caggtctctg atgccggttt gcctagcatt 300
tcagaccctg gtcatgattt agttaaggca gctattgagg aagaaattgc agttgtgaca 360
gttccaggtg cctctgcagg aatttctgcc ttgattgcca gtggtttagc gccacagcca 420
catatctttt acggtttttt accgagaaaa tcaggtcagc agaagcaatt ttttggcttg 480
aaaaaagatt atcctgaaac acagattttt tatgaatcac ctcatcgtgt agcagacacg 540
ttggaaaata tgttagaagt ctacggtgac cgctccgttg tcttggtcag ggaattgacc 600
aaaatctatg aagaatacca acgaggtact atctctgagt tattagaaag cattgctgaa 660
acgccactca agggcgaatg tcttctcatt gttgagggtg ccagtcaggg tgtggaggaa 720
aaggacgagg aagacttgtt cgtagaaatt caaacccgca tccagcaagg tgtgaagaaa 780
aaccaagcta tcaaggaagt cgctaagatt taccagtgga ataaaagtca gctctacgct 840
gcctaccacg actgggaaga aaaacaataa                                  870
```

<210> 130
<211> 289
<212> PRT
<213> Streptococcus pneumoniae

<400> 130
```
Met Gln Ile Gln Lys Ser Phe Lys Gly Gln Ser Pro Tyr Gly Lys Leu
  1               5                  10                  15

Tyr Leu Val Ala Thr Pro Ile Gly Asn Leu Asp Asp Met Thr Phe Arg
             20                  25                  30

Ala Ile Gln Thr Leu Lys Glu Val Asp Trp Ile Ala Ala Glu Asp Thr
         35                  40                  45

Arg Asn Thr Gly Leu Leu Leu Lys His Phe Asp Ile Ser Thr Lys Gln
     50                  55                  60

Ile Ser Phe His Glu His Asn Ala Lys Glu Lys Ile Pro Asp Leu Ile
 65                  70                  75                  80

Gly Phe Leu Lys Ala Gly Gln Ser Ile Ala Gln Val Ser Asp Ala Gly
                 85                  90                  95

Leu Pro Ser Ile Ser Asp Pro Gly His Asp Leu Val Lys Ala Ala Ile
            100                 105                 110
```

```
Glu Glu Glu Ile Ala Val Val Thr Val Pro Gly Ala Ser Ala Gly Ile
        115                 120                 125

Ser Ala Leu Ile Ala Ser Gly Leu Ala Pro Gln Pro His Ile Phe Tyr
    130                 135                 140

Gly Phe Leu Pro Arg Lys Ser Gly Gln Gln Lys Gln Phe Phe Gly Leu
145                 150                 155                 160

Lys Lys Asp Tyr Pro Glu Thr Gln Ile Phe Tyr Glu Ser Pro His Arg
                165                 170                 175

Val Ala Asp Thr Leu Glu Asn Met Leu Glu Val Tyr Gly Asp Arg Ser
            180                 185                 190

Val Val Leu Val Arg Glu Leu Thr Lys Ile Tyr Glu Glu Tyr Gln Arg
        195                 200                 205

Gly Thr Ile Ser Glu Leu Leu Glu Ser Ile Ala Glu Thr Pro Leu Lys
    210                 215                 220

Gly Glu Cys Leu Leu Ile Val Glu Gly Ala Ser Gln Gly Val Glu Glu
225                 230                 235                 240

Lys Asp Glu Glu Asp Leu Phe Val Glu Ile Gln Thr Arg Ile Gln Gln
                245                 250                 255

Gly Val Lys Lys Asn Gln Ala Ile Lys Glu Val Ala Lys Ile Tyr Gln
            260                 265                 270

Trp Asn Lys Ser Gln Leu Tyr Ala Ala Tyr His Asp Trp Glu Glu Lys
        275                 280                 285

Gln
```

<210> 131
<211> 345
<212> DNA
<213> Streptococcus pneumoniae

<400> 131
atgataaaga aaggaaaggg ctgttttatg gacaaaaaag aattatttga cgcgctggat 60
gatttttccc aacaattatt ggtaacctta gccgatgtgg aagccatcaa gaaaaatctc 120
aagagcctgg tagaggaaaa tacagctctt cgcttggaaa atagtaagtt gcgagaacgc 180
ttgggtgagg tggaagcaga tgctcctgtc aaggccaagc atgttcgcga aagtgtccgt 240
cgtatttacc gtgatggatt tcacgtatgt aatgattttt atggacaacg tcgagagcag 300
gacgaagaat gtatgttttg tgacgagttg ttatacaggg agtaa 345

<210> 132
<211> 114
<212> PRT
<213> Streptococcus pneumoniae

<400> 132
Met Ile Lys Lys Gly Lys Gly Cys Phe Met Asp Lys Lys Glu Leu Phe
1 5 10 15

Asp Ala Leu Asp Asp Phe Ser Gln Gln Leu Leu Val Thr Leu Ala Asp
20 25 30

Val Glu Ala Ile Lys Lys Asn Leu Lys Ser Leu Val Glu Glu Asn Thr
35 40 45

Ala Leu Arg Leu Glu Asn Ser Lys Leu Arg Glu Arg Leu Gly Glu Val
50 55 60

Glu Ala Asp Ala Pro Val Lys Ala Lys His Val Arg Glu Ser Val Arg
65 70 75 80

Arg Ile Tyr Arg Asp Gly Phe His Val Cys Asn Asp Phe Tyr Gly Gln
85 90 95

Arg Arg Glu Gln Asp Glu Glu Cys Met Phe Cys Asp Glu Leu Leu Tyr
100 105 110

Arg Glu

<210> 133
<211> 639
<212> DNA
<213> Streptococcus pneumoniae

<400> 133
atgtcaaaag gatttttagt ctctcttgag ggaccagagg gagcaggcaa gaccagtgtt 60
ttagaggctc tgctaccaat tttagaggaa aaaggagtag aggtgttgac gacccgtgaa 120
cctggcggag tcttgattgg ggagaagatt cgggaagtga ttttggatcc aagtcatact 180
cagatggatg ctaaaacaga gctacttctc tatattgcca gtcgcagaca gcatttggtg 240
gaaaaagttc ttccagccct tgaagctggc aagttggtca tcatggatcg ttttatcgat 300
agttctgttg cctatcaggg atttggtcgt ggcttagata ttgaagccat tgactggctc 360
aatcagtttg cgacagatgg cctcaaaccc gatttgacac tctattttga catcgaggtg 420
gaagaagggc tggctcgtat tgctgctaat agtgaccgcg aggttaatcg tttggatttg 480
gaagggttgg acttgcataa aaaagttcgt caaggctacc tttctcttct ggataaagag 540
ggaaatcgca ttgtcaagat tgatgctagt ctccctttgg agcaagttgt ggaaactacc 600
aaggctgtct tgtttgacgg aatgggcttg gccaaatga 639

<210> 134
<211> 212
<212> PRT
<213> Streptococcus pneumoniae

<400> 134
Met Ser Lys Gly Phe Leu Val Ser Leu Glu Gly Pro Glu Gly Ala Gly
1 5 10 15

Lys Thr Ser Val Leu Glu Ala Leu Leu Pro Ile Leu Glu Glu Lys Gly

```
            20                  25                  30

Val Glu Val Leu Thr Thr Arg Glu Pro Gly Gly Val Leu Ile Gly Glu
         35                  40                  45

Lys Ile Arg Glu Val Ile Leu Asp Pro Ser His Thr Gln Met Asp Ala
     50                  55                  60

Lys Thr Glu Leu Leu Leu Tyr Ile Ala Ser Arg Arg Gln His Leu Val
 65                  70                  75                  80

Glu Lys Val Leu Pro Ala Leu Glu Ala Gly Lys Leu Val Ile Met Asp
                 85                  90                  95

Arg Phe Ile Asp Ser Ser Val Ala Tyr Gln Gly Phe Gly Arg Gly Leu
            100                 105                 110

Asp Ile Glu Ala Ile Asp Trp Leu Asn Gln Phe Ala Thr Asp Gly Leu
        115                 120                 125

Lys Pro Asp Leu Thr Leu Tyr Phe Asp Ile Glu Val Glu Glu Gly Leu
    130                 135                 140

Ala Arg Ile Ala Ala Asn Ser Asp Arg Glu Val Asn Arg Leu Asp Leu
145                 150                 155                 160

Glu Gly Leu Asp Leu His Lys Lys Val Arg Gln Gly Tyr Leu Ser Leu
                165                 170                 175

Leu Asp Lys Glu Gly Asn Arg Ile Val Lys Ile Asp Ala Ser Leu Pro
            180                 185                 190

Leu Glu Gln Val Val Glu Thr Thr Lys Ala Val Leu Phe Asp Gly Met
        195                 200                 205

Gly Leu Ala Lys
    210
```

<210> 135
<211> 474
<212> DNA
<213> Streptococcus pneumoniae

<400> 135
atggtagaac aaagaaaatc aattaccatg aaagatgttg ctttagaagc aggagttagt 60
gttggaactg tttcacgtgt aattaataaa gaaaaaggca ttaaagaagt aactttgaaa 120
aaagtggaac aagcgattaa aactttgaat tacattccag attactacgc tagaggaatg 180
aaaaaaaatc gaacagaaac gattgcaatc attgtaccaa gtatctggca tcccttcttt 240
tcagaatttg ctatgcatgt ggaaaatgaa gtctataaga gaaataacaa attactctta 300
tgttctatca atggtacaaa tagagagcaa gactatctgg agatgttgcg tcataataaa 360
gttgatggag tggttgccat tacctatagg ccaattgaac attacttgac gtcaggaatt 420
ccctttgtta gtattgaccg cacatactca gagattgcca ttccttgtgt ttca 474

<210> 136

<211> 158
<212> PRT
<213> Streptococcus pneumoniae

<400> 136
Met Val Glu Gln Arg Lys Ser Ile Thr Met Lys Asp Val Ala Leu Glu
1 5 10 15

Ala Gly Val Ser Val Gly Thr Val Ser Arg Val Ile Asn Lys Glu Lys
20 25 30

Gly Ile Lys Glu Val Thr Leu Lys Lys Val Glu Gln Ala Ile Lys Thr
35 40 45

Leu Asn Tyr Ile Pro Asp Tyr Tyr Ala Arg Gly Met Lys Lys Asn Arg
50 55 60

Thr Glu Thr Ile Ala Ile Ile Val Pro Ser Ile Trp His Pro Phe Phe
65 70 75 80

Ser Glu Phe Ala Met His Val Glu Asn Glu Val Tyr Lys Arg Asn Asn
85 90 95

Lys Leu Leu Leu Cys Ser Ile Asn Gly Thr Asn Arg Glu Gln Asp Tyr
100 105 110

Leu Glu Met Leu Arg His Asn Lys Val Asp Gly Val Val Ala Ile Thr
115 120 125

Tyr Arg Pro Ile Glu His Tyr Leu Thr Ser Gly Ile Pro Phe Val Ser
130 135 140

Ile Asp Arg Thr Tyr Ser Glu Ile Ala Ile Pro Cys Val Ser
145 150 155

<210> 137
<211> 374
<212> DNA
<213> Streptococcus pneumoniae

<400> 137
atgaatatat ttagaacaaa gaatgttagt ttagataaaa cagagatgca taggcatttg 60
aagttatggg atttgatttt gctgggtatc ggagccatgg tagggacagg cgtctttaca 120
atcacaggta ctgcagctgc aacacttgct ggcccagccc tagtgatttc aatcgttatt 180
tctgccttgt gtgtgggatt atcagccctc ttttttgcag aatttgcctc gcgagtaccc 240
gctacaggag gtgcctatag ttacctctat gctatcttag gagaattccc tgcctggttg 300
gctggttggt taaccatgat ggagttcatg acagccatat caggcgtagc ttcgggttgg 360
gcagcttatt ttaa 374

<210> 138
<211> 124
<212> PRT
<213> Streptococcus pneumoniae

<400> 138
Met Asn Ile Phe Arg Thr Lys Asn Val Ser Leu Asp Lys Thr Glu Met
1 5 10 15

His Arg His Leu Lys Leu Trp Asp Leu Ile Leu Leu Gly Ile Gly Ala
20 25 30

Met Val Gly Thr Gly Val Phe Thr Ile Thr Gly Thr Ala Ala Ala Thr
35 40 45

Leu Ala Gly Pro Ala Leu Val Ile Ser Ile Val Ile Ser Ala Leu Cys
50 55 60

Val Gly Leu Ser Ala Leu Phe Phe Ala Glu Phe Ala Ser Arg Val Pro
65 70 75 80

Ala Thr Gly Gly Ala Tyr Ser Tyr Leu Tyr Ala Ile Leu Gly Glu Phe
85 90 95

Pro Ala Trp Leu Ala Gly Trp Leu Thr Met Met Glu Phe Met Thr Ala
100 105 110

Ile Ser Gly Val Ala Ser Gly Trp Ala Ala Tyr Phe
115 120

<210> 139
<211> 1311
<212> DNA
<213> Streptococcus pneumoniae

<400> 139
atgaaatcaa gagtaaagga aacgagtatg gataaaattg tggttcaagg tggcgataat 60
cgtctggtag gaagcgtgac gatcgaggga gcaaaaaatg cagtcttacc cttgttggca 120
gcgactattc tagcaagtga aggaaagacc gtcttgcaga atgttccgat tttgtcggat 180
gtctttatta tgaatcaggt agttggtggt ttgaatgcca aggttgactt tgatgaggaa 240
gctcatcttg tcaaggtgga tgctactggc gacatcactg aggaagcccc ttacaagtat 300
gtcagcaaga tgcgcgcctc catcgttgta ttagggccaa tccttgcccg tgtgggtcat 360
gccaaggtat ccatgccagg tggttgtacg attggtagcc gtcctattga tcttcatttg 420
aaaggtctgg aagctatggg ggttaagatt agtcagacag ctggttacat cgaagccaag 480
gcagaacgct tgcatggtgc tcatatctat atggactttc caagtgttgg tgcaacgcag 540
aacttgatga tggcagcgac tctggctgat ggggtgacag tgattgagaa tgctgcgcgt 600
gagcctgaga ttgttgactt agccattctc cttaatgaaa tgggagccaa ggtcaaaggt 660
gctggtacag agactataac cattactggt gttgagaaac ttcatggtac gactcacaat 720
gtagtccaag accgtatcga agcaggaacc tttatggtag ctgctgccat gactggtggt 780
gatgtcttga ttcgagacgc tgtctgggag cacaaccgtc ccttgattgc caagttactt 840
gaaatgggtg ttgaagtaat tgaagaagac gaaggaattc gtgttcgttc tcaactagaa 900
aatctaaaag ctgttcatgt gaaaaccttg ccccacccag gatttccaac agatatgcag 960
gctcaattta cagccttgat gacagttgca aaaggcgaat caaccatggt ggagacagtt 1020
ttcgaaaatc gtttccaaca cctagaagag atgcgccgca tgggcttgca ttctgagatt 1080
atccgtgata cagctcgtat tgttggtgga cagcctttgc agggagcaga agttctttca 1140
actgaccttc gtgccagtgc ggccttgatt ttgacaggtt tggtagcaca gggagaaact 1200
gtggtcggta aattggttca cttggataga ggttactacg gtttccatga gaagttggcg 1260
cagctaggtg ctaagattca gcggattgag gcaagtgatg aagatgaata a 1311

<210> 140
<211> 436
<212> PRT
<213> Streptococcus pneumoniae

<400> 140
Met Lys Ser Arg Val Lys Glu Thr Ser Met Asp Lys Ile Val Val Gln
1 5 10 15

Gly Gly Asp Asn Arg Leu Val Gly Ser Val Thr Ile Glu Gly Ala Lys
20 25 30

Asn Ala Val Leu Pro Leu Leu Ala Ala Thr Ile Leu Ala Ser Glu Gly
35 40 45

Lys Thr Val Leu Gln Asn Val Pro Ile Leu Ser Asp Val Phe Ile Met
50 55 60

Asn Gln Val Val Gly Gly Leu Asn Ala Lys Val Asp Phe Asp Glu Glu
65 70 75 80

Ala His Leu Val Lys Val Asp Ala Thr Gly Asp Ile Thr Glu Glu Ala
85 90 95

Pro Tyr Lys Tyr Val Ser Lys Met Arg Ala Ser Ile Val Val Leu Gly
100 105 110

Pro Ile Leu Ala Arg Val Gly His Ala Lys Val Ser Met Pro Gly Gly
115 120 125

Cys Thr Ile Gly Ser Arg Pro Ile Asp Leu His Leu Lys Gly Leu Glu
130 135 140

Ala Met Gly Val Lys Ile Ser Gln Thr Ala Gly Tyr Ile Glu Ala Lys
145 150 155 160

Ala Glu Arg Leu His Gly Ala His Ile Tyr Met Asp Phe Pro Ser Val
165 170 175

Gly Ala Thr Gln Asn Leu Met Met Ala Ala Thr Leu Ala Asp Gly Val
180 185 190

Thr Val Ile Glu Asn Ala Ala Arg Glu Pro Glu Ile Val Asp Leu Ala
195 200 205

Ile Leu Leu Asn Glu Met Gly Ala Lys Val Lys Gly Ala Gly Thr Glu
210 215 220

Thr Ile Thr Ile Thr Gly Val Glu Lys Leu His Gly Thr Thr His Asn
225 230 235 240

Val Val Gln Asp Arg Ile Glu Ala Gly Thr Phe Met Val Ala Ala Ala
245 250 255

Met Thr Gly Gly Asp Val Leu Ile Arg Asp Ala Val Trp Glu His Asn
260 265 270

```
Arg Pro Leu Ile Ala Lys Leu Leu Glu Met Gly Val Glu Val Ile Glu
        275                 280                 285

Glu Asp Glu Gly Ile Arg Val Arg Ser Gln Leu Glu Asn Leu Lys Ala
    290                 295                 300

Val His Val Lys Thr Leu Pro His Pro Gly Phe Pro Thr Asp Met Gln
305                 310                 315                 320

Ala Gln Phe Thr Ala Leu Met Thr Val Ala Lys Gly Glu Ser Thr Met
                325                 330                 335

Val Glu Thr Val Phe Glu Asn Arg Phe Gln His Leu Glu Glu Met Arg
            340                 345                 350

Arg Met Gly Leu His Ser Glu Ile Ile Arg Asp Thr Ala Arg Ile Val
        355                 360                 365

Gly Gly Gln Pro Leu Gln Gly Ala Glu Val Leu Ser Thr Asp Leu Arg
    370                 375                 380

Ala Ser Ala Ala Leu Ile Leu Thr Gly Leu Val Ala Gln Gly Glu Thr
385                 390                 395                 400

Val Val Gly Lys Leu Val His Leu Asp Arg Gly Tyr Tyr Gly Phe His
                405                 410                 415

Glu Lys Leu Ala Gln Leu Gly Ala Lys Ile Gln Arg Ile Glu Ala Ser
            420                 425                 430

Asp Glu Asp Glu
        435
```

<210> 141
<211> 1101
<212> DNA
<213> Streptococcus pneumoniae

<400> 141
atgttattag cgtcaacagt agccttgtca tttgccccag tattggcaac tcaagcagaa 60
gaagttcttt ggactgcacg tagtgttgag caaatccaaa acgatttgac taaaacggac 120
aacaaaacaa gttataccgt acagtatggt gatactttga gcaccattgc agaagccttg 180
ggtgtagatg tcacagtgct tgcgaatctg aacaaaatca ctaatatgga cttgattttc 240
ccagaaactg ttttgacaac gactgtcaat gaagcagaag aagtaacaga agttgaaatc 300
caaacacctc aagcagactc tagtgaagaa gtgacaactg cgacagcaga tttgaccact 360
aatcaagtga ccgttgatga tcaaactgtt caggttgcag acctttctca accaattgca 420
gaagttacaa agacagtgat tgcttctgaa gaagtggcac catctacggg cacttctgtc 480
ccagaggagc aaacgaccga aacaactcgc ccagttgcag aagaagctcc tcaggaaacg 540
actccagctg agaagcagga aacacaaaca agccctcaag ctgcatcagc agtggaagca 600
actacaacaa gttcagaagc aaaagaagta gcatcatcaa atggagctac agcagcagtt 660
tctacttatc aaccagaaga aacgaaagta atttcaacaa cttacgaggc tccagctgcg 720
cccgattatg ctggacttgc agtagcaaaa tctgaaaatg caggtcttca accacaaaca 780
gctgccttta agaagaaatt gctaacttgt ttggcattac atcctttagt ggttatcgtc 840
caggagacag tggagatcac ggaaaaggtt tggctatcga ctttatggta ccagaacgtt 900
cagaattagg ggataagatt gcggaatatg ctattcaaaa tatggccagc cgtggcatta 960

gttacatcat ctggaaacaa cgtttctatg ctccattcga tagcaaatat gggccagcta 1020
acacttggaa cccaatgcca gaccgtggta gtgtgacaga aaatcactat gatcacgttc 1080
acgtttcaat gaatggataa 1100

<210> 142
<211> 302
<212> PRT
<213> Streptococcus pneumoniae

<400> 142
Met Leu Leu Ala Ser Thr Val Ala Leu Ser Phe Ala Pro Val Leu Ala
1 5 10 15

Thr Gln Ala Glu Glu Val Leu Trp Thr Ala Arg Ser Val Glu Gln Ile
20 25 30

Gln Asn Asp Leu Thr Lys Thr Asp Asn Lys Thr Ser Tyr Thr Val Gln
35 40 45

Tyr Gly Asp Thr Leu Ser Thr Ile Ala Glu Ala Leu Gly Val Asp Val
50 55 60

Thr Val Leu Ala Asn Leu Asn Lys Ile Thr Asn Met Asp Leu Ile Phe
65 70 75 80

Pro Glu Thr Val Leu Thr Thr Thr Val Asn Glu Ala Glu Glu Val Thr
85 90 95

Glu Val Glu Ile Gln Thr Pro Gln Ala Asp Ser Ser Glu Glu Val Thr
100 105 110

Thr Ala Thr Ala Asp Leu Thr Thr Asn Gln Val Thr Val Asp Asp Gln
115 120 125

Thr Val Gln Val Ala Asp Leu Ser Gln Pro Ile Ala Glu Val Thr Lys
130 135 140

Thr Val Ile Ala Ser Glu Glu Val Ala Pro Ser Thr Gly Thr Ser Val
145 150 155 160

Pro Glu Glu Gln Thr Thr Glu Thr Thr Arg Pro Val Ala Glu Glu Ala
165 170 175

Pro Gln Glu Thr Thr Pro Ala Glu Lys Gln Glu Thr Gln Thr Ser Pro
180 185 190

Gln Ala Ala Ser Ala Val Glu Ala Thr Thr Thr Ser Ser Glu Ala Lys
195 200 205

Glu Val Ala Ser Ser Asn Gly Ala Thr Ala Ala Val Ser Thr Tyr Gln
210 215 220

Pro Glu Glu Thr Lys Val Ile Ser Thr Thr Tyr Glu Ala Pro Ala Ala

```
225                 230                 235                 240

Pro Asp Tyr Ala Gly Leu Ala Val Ala Lys Ser Glu Asn Ala Gly Leu
                245                 250                 255

Gln Pro Gln Thr Ala Ala Phe Lys Lys Lys Leu Leu Thr Cys Leu Ala
            260                 265                 270

Leu His Pro Leu Val Val Ile Val Gln Glu Thr Val Glu Ile Thr Glu
        275                 280                 285

Lys Val Trp Leu Ser Thr Leu Trp Tyr Gln Asn Val Gln Asn
    290                 295                 300
```

<210> 143
<211> 1281
<212> DNA
<213> Streptococcus pneumoniae

<400> 143
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ttgtttaaga aaaataaaga cattcttaat attgcattgc cagctatggg tgaaaacttt 60
ttgcagatgc taatgggaat ggtggacagt tatttggttg ctcatttagg attgatagct 120
atttcagggg tttcagtagc tggtaatatt atcaccattt atcaggcgat tttcatcgct 180
ctgggagctg ctatttccag tgttatttca aaaagcatag ggcagaaaga ccagtcgaag 240
ttggcctatc atgtgactga ggcgttgaag attaccttac tattaagttt ccttttagga 300
tttttgtcca tcttcgctgg gaaagagatg ataggacttt tggggacgga gagggatgta 360
gctgagagtg gtggactgta tctatctttg gtaggcggat cgattgttct cttaggttta 420
atgactagtc taggagcctt gattcgtgca acgcataatc cacgtctgcc tctctatgtt 480
agtttttat ccaatgcctt gaatattctt ttttcaagtc tagctatttt tgttctggat 540
atggggatag ctggtgttgc ttgggggaca attgtgtctc gtttggttgg tcttgtgatt 600
ttgtggtcac aattaaaact gccttatggg aagccaactt ttggtttaga taaggaactg 660
ttgaccttgg ctttaccagc agctggagag cgacttatga tgagggctgg agatgtagtg 720
atcattgcct tggtcgtttc ttttgggacg gaggcagttg ctgggaatgc aatcggagaa 780
gtcttgaccc agtttaacta tatgcctgcc tttggcgtcg ctacggcaac ggtcatgctg 840
ttggcccgag cagttggaga ggatgattgg aaaagagttg ctagtttgag taaacaaacc 900
ttttggcttt ctctgttcct catgttgccc ctgtccttta gtatatatgt cttgggtgta 960
ccattaactc atctctatac gactgattct ctagcggtgg aggctagtgt tctagtgaca 1020
ctgttttcac tacttgggac ccctatgacg acaggaacag tcatctatac ggcagtctgg 1080
cagggattag gaaatgcacg cctccctttt tatgcgacaa gtataggaat gtggtgtatc 1140
cgcattggga caggatatct gatggggatt gtgcttggtt ggggcttgcc tggtatttgg 1200
gcagggtctc tcttggataa tggttttcgc tggttatttc tacgctatcg ttaccagcgc 1260
tatatgagct tgaaaggata g                                          1281
```

<210> 144
<211> 426
<212> PRT
<213> Streptococcus pneumoniae

<400> 144
```
Leu Phe Lys Lys Asn Lys Asp Ile Leu Asn Ile Ala Leu Pro Ala Met
  1               5                  10                  15

Gly Glu Asn Phe Leu Gln Met Leu Met Gly Met Val Asp Ser Tyr Leu
             20                  25                  30
```

```
Val Ala His Leu Gly Leu Ile Ala Ile Ser Gly Val Ser Val Ala Gly
         35                  40                  45

Asn Ile Ile Thr Ile Tyr Gln Ala Ile Phe Ile Ala Leu Gly Ala Ala
     50                  55                  60

Ile Ser Ser Val Ile Ser Lys Ser Ile Gly Gln Lys Asp Gln Ser Lys
 65                  70                  75                  80

Leu Ala Tyr His Val Thr Glu Ala Leu Lys Ile Thr Leu Leu Leu Ser
                 85                  90                  95

Phe Leu Leu Gly Phe Leu Ser Ile Phe Ala Gly Lys Glu Met Ile Gly
            100                 105                 110

Leu Leu Gly Thr Glu Arg Asp Val Ala Glu Ser Gly Gly Leu Tyr Leu
        115                 120                 125

Ser Leu Val Gly Gly Ser Ile Val Leu Leu Gly Leu Met Thr Ser Leu
    130                 135                 140

Gly Ala Leu Ile Arg Ala Thr His Asn Pro Arg Leu Pro Leu Tyr Val
145                 150                 155                 160

Ser Phe Leu Ser Asn Ala Leu Asn Ile Leu Phe Ser Ser Leu Ala Ile
                165                 170                 175

Phe Val Leu Asp Met Gly Ile Ala Gly Val Ala Trp Gly Thr Ile Val
            180                 185                 190

Ser Arg Leu Val Gly Leu Val Ile Leu Trp Ser Gln Leu Lys Leu Pro
        195                 200                 205

Tyr Gly Lys Pro Thr Phe Gly Leu Asp Lys Glu Leu Leu Thr Leu Ala
    210                 215                 220

Leu Pro Ala Ala Gly Glu Arg Leu Met Met Arg Ala Gly Asp Val Val
225                 230                 235                 240

Ile Ile Ala Leu Val Val Ser Phe Gly Thr Glu Ala Val Ala Gly Asn
                245                 250                 255

Ala Ile Gly Glu Val Leu Thr Gln Phe Asn Tyr Met Pro Ala Phe Gly
            260                 265                 270

Val Ala Thr Ala Thr Val Met Leu Leu Ala Arg Ala Val Gly Glu Asp
        275                 280                 285

Asp Trp Lys Arg Val Ala Ser Leu Ser Lys Gln Thr Phe Trp Leu Ser
    290                 295                 300

Leu Phe Leu Met Leu Pro Leu Ser Phe Ser Ile Tyr Val Leu Gly Val
305                 310                 315                 320

Pro Leu Thr His Leu Tyr Thr Thr Asp Ser Leu Ala Val Glu Ala Ser
                325                 330                 335
```

```
Val Leu Val Thr Leu Phe Ser Leu Leu Gly Thr Pro Met Thr Thr Gly
            340                 345                 350

Thr Val Ile Tyr Thr Ala Val Trp Gln Gly Leu Gly Asn Ala Arg Leu
        355                 360                 365

Pro Phe Tyr Ala Thr Ser Ile Gly Met Trp Cys Ile Arg Ile Gly Thr
    370                 375                 380

Gly Tyr Leu Met Gly Ile Val Leu Gly Trp Gly Leu Pro Gly Ile Trp
385                 390                 395                 400

Ala Gly Ser Leu Leu Asp Asn Gly Phe Arg Trp Leu Phe Leu Arg Tyr
                405                 410                 415

Arg Tyr Gln Arg Tyr Met Ser Leu Lys Gly
            420                 425
```

<210> 145
<211> 894
<212> DNA
<213> Streptococcus pneumoniae

<400> 145
```
gtgggaagaa ttatcagagc aggtgtaaag atggaacatc ttggaaaagt atttcgtgaa 60
tttcgaacaa gtggaaatta ttctttaaag gaagcagcag gcgaatcctg ctctacctct 120
cagttatctc gctttgagct tggggagtct gacctggcag tctcccgttt ctttgagatt 180
ttggataaca ttcatgtaac aatcgaaaat ttcatggata aggcaaggaa ttttcataat 240
catgaacatg tgtctatgat ggcacagatt atcccacttt actattcaaa cgatattgca 300
ggttttcaaa agcttcaaag agaacaactt gaaaagtcta agagttcgac gactcccctt 360
tattttgagc tgaactggat tttgctacaa ggtctgattt gtcaaagaga tgcgagttat 420
gatatgaagc aggatgattt gggtaaggta gcagattatc tcttcaaaac agaagaatgg 480
accatgtatg agttgattct tttcggtaac ctctatagtt tctacgatgt agactatgtc 540
actcggattg gtagagaagt tatggagagg gaggaatttt accaagagat tagtcgccat 600
aagagattag tgttgatttt ggccctcaat tgttaccagc attgtttaga gcattcttct 660
ttttataatg ccaactattt tgaggcttat acagagaaga ttattgacaa aggtattaag 720
ctttatgagc gtaatgtttt ccattattta aaaggttttg ccttatatca aaaaggacag 780
tgtaaagaag gctgtaagca gatgcaagag gccatgcata tttttgatgt gttaggtctt 840
ccagagcaag tagcctatta tcaggaacac tacgaaaaat ttgtcaaaag ttaa       894
```

<210> 146
<211> 297
<212> PRT
<213> Streptococcus pneumoniae

<400> 146
```
Val Gly Arg Ile Ile Arg Ala Gly Val Lys Met Glu His Leu Gly Lys
  1               5                  10                  15

Val Phe Arg Glu Phe Arg Thr Ser Gly Asn Tyr Ser Leu Lys Glu Ala
             20                  25                  30

Ala Gly Glu Ser Cys Ser Thr Ser Gln Leu Ser Arg Phe Glu Leu Gly
```

```
         35                  40                  45

Glu Ser Asp Leu Ala Val Ser Arg Phe Phe Glu Ile Leu Asp Asn Ile
     50                  55                  60

His Val Thr Ile Glu Asn Phe Met Asp Lys Ala Arg Asn Phe His Asn
 65                  70                  75                  80

His Glu His Val Ser Met Met Ala Gln Ile Ile Pro Leu Tyr Tyr Ser
                 85                  90                  95

Asn Asp Ile Ala Gly Phe Gln Lys Leu Gln Arg Glu Gln Leu Glu Lys
            100                 105                 110

Ser Lys Ser Ser Thr Thr Pro Leu Tyr Phe Glu Leu Asn Trp Ile Leu
        115                 120                 125

Leu Gln Gly Leu Ile Cys Gln Arg Asp Ala Ser Tyr Asp Met Lys Gln
    130                 135                 140

Asp Asp Leu Gly Lys Val Ala Asp Tyr Leu Phe Lys Thr Glu Glu Trp
145                 150                 155                 160

Thr Met Tyr Glu Leu Ile Leu Phe Gly Asn Leu Tyr Ser Phe Tyr Asp
                165                 170                 175

Val Asp Tyr Val Thr Arg Ile Gly Arg Glu Val Met Glu Arg Glu Glu
            180                 185                 190

Phe Tyr Gln Glu Ile Ser Arg His Lys Arg Leu Val Leu Ile Leu Ala
        195                 200                 205

Leu Asn Cys Tyr Gln His Cys Leu Glu His Ser Ser Phe Tyr Asn Ala
    210                 215                 220

Asn Tyr Phe Glu Ala Tyr Thr Glu Lys Ile Ile Asp Lys Gly Ile Lys
225                 230                 235                 240

Leu Tyr Glu Arg Asn Val Phe His Tyr Leu Lys Gly Phe Ala Leu Tyr
                245                 250                 255

Gln Lys Gly Gln Cys Lys Glu Gly Cys Lys Gln Met Gln Glu Ala Met
            260                 265                 270

His Ile Phe Asp Val Leu Gly Leu Pro Glu Gln Val Ala Tyr Tyr Gln
        275                 280                 285

Glu His Tyr Glu Lys Phe Val Lys Ser
    290                 295
```

<210> 147
<211> 1068
<212> DNA
<213> Streptococcus pneumoniae

<400> 147
atgtctaaca ttcaaaacat gtccctggag gacatcatgg gagagcgctt tggtcgctac 60
tccaagtaca ttattcaaga ccgggctttg ccagatattc gtgatgggtt gaagccggtt 120
cagcgccgta ttctttattc tatgaataag gatagcaata cttttgacaa gagctaccgt 180
aagtcggcca agtcagtcgg gaacatcatg gggaatttcc acccacacgg ggattcttct 240
atctatgatg ccatggttcg tatgtcacag aactggaaaa atcgtgagat tctagttgaa 300
atgcacggta ataacggttc tatggacgga gatcctcctg cggctatgcg ttatactgag 360
gcacgtttgt ctgaaattgc aggctacctt cttcaggata tcgagaaaaa gacagttcct 420
tttgcatgga actttgacga tacggagaaa gaaccaacgg tcttgccagc agcctttcca 480
aacctcttgg tcaatggttc gactgggatt tcggctggtt atgccacaga cattcctccc 540
cataatttag ctgaggtcat agatgctgca gtttacatga ttgaccaccc aactgcaaag 600
attgataaac tcatggaatt cttgcctgga ccagacttcc ctacaggggc tattattcag 660
ggtcgtgatg aaatcaagaa agcttatgag actgggaaag ggcgcgtggt tgttcgttcc 720
aagactgaaa ttgaaaagct aaaaggtggt aaggaacaaa tcgttattat tgagattcct 780
tatgaaatca ataaggccaa tctagtcaag aaaatcgatg atgttcgtgt taataacaag 840
gtagctggga ttgctgaggt tcgtgatgag tctgaccgtg atggtcttcg tatcgctatc 900
gaacttaaga aagacgctaa tactgagctt gttctcaact acttatttaa gtacaccgac 960
ctacaaatca actacaactt taatatggtg gcgattgaca atttcacacc tcgtcaggtt 1020
ggattgttcc aatcctgtct agctatatcg ctcaccgtcg agaagtga 1068

<210> 148
<211> 355
<212> PRT
<213> Streptococcus pneumoniae

<400> 148
Met Ser Asn Ile Gln Asn Met Ser Leu Glu Asp Ile Met Gly Glu Arg
1 5 10 15

Phe Gly Arg Tyr Ser Lys Tyr Ile Ile Gln Asp Arg Ala Leu Pro Asp
20 25 30

Ile Arg Asp Gly Leu Lys Pro Val Gln Arg Arg Ile Leu Tyr Ser Met
35 40 45

Asn Lys Asp Ser Asn Thr Phe Asp Lys Ser Tyr Arg Lys Ser Ala Lys
50 55 60

Ser Val Gly Asn Ile Met Gly Asn Phe His Pro His Gly Asp Ser Ser
65 70 75 80

Ile Tyr Asp Ala Met Val Arg Met Ser Gln Asn Trp Lys Asn Arg Glu
85 90 95

Ile Leu Val Glu Met His Gly Asn Asn Gly Ser Met Asp Gly Asp Pro
100 105 110

Pro Ala Ala Met Arg Tyr Thr Glu Ala Arg Leu Ser Glu Ile Ala Gly
115 120 125

Tyr Leu Leu Gln Asp Ile Glu Lys Lys Thr Val Pro Phe Ala Trp Asn
130 135 140

Phe Asp Asp Thr Glu Lys Glu Pro Thr Val Leu Pro Ala Ala Phe Pro
145 150 155 160

```
Asn Leu Leu Val Asn Gly Ser Thr Gly Ile Ser Ala Gly Tyr Ala Thr
                165                 170                 175

Asp Ile Pro Pro His Asn Leu Ala Glu Val Ile Asp Ala Ala Val Tyr
            180                 185                 190

Met Ile Asp His Pro Thr Ala Lys Ile Asp Lys Leu Met Glu Phe Leu
        195                 200                 205

Pro Gly Pro Asp Phe Pro Thr Gly Ala Ile Ile Gln Gly Arg Asp Glu
    210                 215                 220

Ile Lys Lys Ala Tyr Glu Thr Gly Lys Gly Arg Val Val Val Arg Ser
225                 230                 235                 240

Lys Thr Glu Ile Glu Lys Leu Lys Gly Gly Lys Glu Gln Ile Val Ile
                245                 250                 255

Ile Glu Ile Pro Tyr Glu Ile Asn Lys Ala Asn Leu Val Lys Lys Ile
            260                 265                 270

Asp Asp Val Arg Val Asn Asn Lys Val Ala Gly Ile Ala Glu Val Arg
        275                 280                 285

Asp Glu Ser Asp Arg Asp Gly Leu Arg Ile Ala Ile Glu Leu Lys Lys
    290                 295                 300

Asp Ala Asn Thr Glu Leu Val Leu Asn Tyr Leu Phe Lys Tyr Thr Asp
305                 310                 315                 320

Leu Gln Ile Asn Tyr Asn Phe Asn Met Val Ala Ile Asp Asn Phe Thr
                325                 330                 335

Pro Arg Gln Val Gly Leu Phe Gln Ser Cys Leu Ala Ile Ser Leu Thr
            340                 345                 350

Val Glu Lys
        355
```

<210> 149
<211> 684
<212> DNA
<213> Streptococcus pneumoniae

<400> 149
atgccgacat tagaaatagc acaaaaaaaa ctggagttca ttaagaaggc agaagaatat 60
tacaatgcct tgtgtacaaa tatacagttg agcggagata aactaaaagt aatttccgtt 120
acttctgtta accctgggga aggaaaaaca actacttcca taaatatagc atggtcgttt 180
gcgcgtgcag gctataaaac tcttttgatc gatggcgata ctcgaaattc agttatgtta 240
ggagttttta aatctcgtga aaaaattaca gggctaacag aatttttatc tgggacagct 300
gatttatctc acggtttatg tgatacaaat attgaaaatt tatttgtagt tcaatcggga 360
tctgtatcac caaaccctac agccttgtta caaagtaaaa attttaatga tatgattgaa 420
acattgcgta aatattttga ttatatcatt attgatacac cgcctattgg aattgttatt 480
gatgcggcaa ttatcactca aaagtgtgat gcgtccatct tggtaacagc aacaggtgag 540
gcgaataaac gtgatatcca aaaagcgaaa caacaattaa aacaaacagg gaaactgttc 600

ctaggagttg ttttaaataa attggatatc tcggttaata agtatggagt ttacggttcc 660
tatggaaatt atggtaaaaa ataa 684

<210> 150
<211> 227
<212> PRT
<213> Streptococcus pneumoniae

<400> 150
Met Pro Thr Leu Glu Ile Ala Gln Lys Lys Leu Glu Phe Ile Lys Lys
1 5 10 15

Ala Glu Glu Tyr Tyr Asn Ala Leu Cys Thr Asn Ile Gln Leu Ser Gly
20 25 30

Asp Lys Leu Lys Val Ile Ser Val Thr Ser Val Asn Pro Gly Glu Gly
35 40 45

Lys Thr Thr Thr Ser Ile Asn Ile Ala Trp Ser Phe Ala Arg Ala Gly
50 55 60

Tyr Lys Thr Leu Leu Ile Asp Gly Asp Thr Arg Asn Ser Val Met Leu
65 70 75 80

Gly Val Phe Lys Ser Arg Glu Lys Ile Thr Gly Leu Thr Glu Phe Leu
85 90 95

Ser Gly Thr Ala Asp Leu Ser His Gly Leu Cys Asp Thr Asn Ile Glu
100 105 110

Asn Leu Phe Val Val Gln Ser Gly Ser Val Ser Pro Asn Pro Thr Ala
115 120 125

Leu Leu Gln Ser Lys Asn Phe Asn Asp Met Ile Glu Thr Leu Arg Lys
130 135 140

Tyr Phe Asp Tyr Ile Ile Ile Asp Thr Pro Pro Ile Gly Ile Val Ile
145 150 155 160

Asp Ala Ala Ile Ile Thr Gln Lys Cys Asp Ala Ser Ile Leu Val Thr
165 170 175

Ala Thr Gly Glu Ala Asn Lys Arg Asp Ile Gln Lys Ala Lys Gln Gln
180 185 190

Leu Lys Gln Thr Gly Lys Leu Phe Leu Gly Val Val Leu Asn Lys Leu
195 200 205

Asp Ile Ser Val Asn Lys Tyr Gly Val Tyr Gly Ser Tyr Gly Asn Tyr
210 215 220

Gly Lys Lys
225

<210> 151
<211> 1194
<212> DNA
<213> Streptococcus pneumoniae

<400> 151
atggaggcaa atatgaaaca tctaaaaaca ttttacaaaa aatggtttca attattagtc 60
gttatcgtca ttagcttttt tagtggagcc ttgggtagtt tttcaataac tcaactaact 120
caaaaaagta gtgtaaacaa ctctaacaac aatagtacta ttacacaaac tgcctataag 180
aacgaaaatt caacaacaca ggctgttaac aaagtaaaag atgctgttgt ttctgttatt 240
acttattcgg caaacagaca aaatagcgta tttggcaatg atgatactga cacagattct 300
cagcgaatct ctagtgaagg atctggagtt atttataaaa agaatgataa agaagcttac 360
atcgtcacca acaatcacgt tattaatggc gccagcaaag tagatattcg attgtcagat 420
gggactaaag tacctggaga aattgtcgga gctgacactt tctctgatat tgctgtcgtc 480
aaaatctctt cagaaaaagt gacaacagta gctgagtttg gtgattctag taagttaact 540
gtaggagaaa ctgctattgc catcggtagc ccgttaggtt ctgaatatgc aaatactgtc 600
actcaaggta tcgtatccag tctcaataga aatgtatcct taaaatcgga agatggacaa 660
gctatttcta caaaagccat ccaaactgat actgctatta acccaggtaa ctctggcggc 720
ccactgatca atattcaagg gcaggttatc ggaattacct caagtaaaat tgctacaaat 780
ggaggaacat ctgtagaagg tcttggtttc gcaattcctg caaatgatgc tatcaatatt 840
attgaacagt tagaaaaaaa cggaaaagtg acgcgtccag ctttgggaat ccagatggtt 900
aatttatcta atgtgagtac aagcgacatc agaagactca atattccaag taatgttaca 960
tctggtgtaa ttgttcgttc ggtacaaagt aatatgcctg ccaatggtca ccttgaaaaa 1020
tacgatgtaa ttacaaaagt agatgacaaa gagattgctt catcaacaga cttacaaagt 1080
gctctttaca accattctat cggagacacc attaagataa cctactatcg taacgggaaa 1140
gaagaaacta cctctatcaa acttaacaag agttcaggtg atttagaatc ttaa 1194

<210> 152
<211> 397
<212> PRT
<213> Streptococcus pneumoniae

<400> 152
Met Glu Ala Asn Met Lys His Leu Lys Thr Phe Tyr Lys Lys Trp Phe
1 5 10 15

Gln Leu Leu Val Val Ile Val Ile Ser Phe Phe Ser Gly Ala Leu Gly
20 25 30

Ser Phe Ser Ile Thr Gln Leu Thr Gln Lys Ser Ser Val Asn Asn Ser
35 40 45

Asn Asn Asn Ser Thr Ile Thr Gln Thr Ala Tyr Lys Asn Glu Asn Ser
50 55 60

Thr Thr Gln Ala Val Asn Lys Val Lys Asp Ala Val Val Ser Val Ile
65 70 75 80

Thr Tyr Ser Ala Asn Arg Gln Asn Ser Val Phe Gly Asn Asp Asp Thr
85 90 95

Asp Thr Asp Ser Gln Arg Ile Ser Ser Glu Gly Ser Gly Val Ile Tyr
100 105 110

Lys Lys Asn Asp Lys Glu Ala Tyr Ile Val Thr Asn Asn His Val Ile
115 120 125

```
Asn Gly Ala Ser Lys Val Asp Ile Arg Leu Ser Asp Gly Thr Lys Val
    130                 135                 140

Pro Gly Glu Ile Val Gly Ala Asp Thr Phe Ser Asp Ile Ala Val Val
145                 150                 155                 160

Lys Ile Ser Ser Glu Lys Val Thr Thr Val Ala Glu Phe Gly Asp Ser
                165                 170                 175

Ser Lys Leu Thr Val Gly Glu Thr Ala Ile Ala Ile Gly Ser Pro Leu
            180                 185                 190

Gly Ser Glu Tyr Ala Asn Thr Val Thr Gln Gly Ile Val Ser Ser Leu
        195                 200                 205

Asn Arg Asn Val Ser Leu Lys Ser Glu Asp Gly Gln Ala Ile Ser Thr
    210                 215                 220

Lys Ala Ile Gln Thr Asp Thr Ala Ile Asn Pro Gly Asn Ser Gly Gly
225                 230                 235                 240

Pro Leu Ile Asn Ile Gln Gly Gln Val Ile Gly Ile Thr Ser Ser Lys
                245                 250                 255

Ile Ala Thr Asn Gly Gly Thr Ser Val Glu Gly Leu Gly Phe Ala Ile
            260                 265                 270

Pro Ala Asn Asp Ala Ile Asn Ile Ile Glu Gln Leu Glu Lys Asn Gly
        275                 280                 285

Lys Val Thr Arg Pro Ala Leu Gly Ile Gln Met Val Asn Leu Ser Asn
    290                 295                 300

Val Ser Thr Ser Asp Ile Arg Arg Leu Asn Ile Pro Ser Asn Val Thr
305                 310                 315                 320

Ser Gly Val Ile Val Arg Ser Val Gln Ser Asn Met Pro Ala Asn Gly
                325                 330                 335

His Leu Glu Lys Tyr Asp Val Ile Thr Lys Val Asp Asp Lys Glu Ile
            340                 345                 350

Ala Ser Ser Thr Asp Leu Gln Ser Ala Leu Tyr Asn His Ser Ile Gly
        355                 360                 365

Asp Thr Ile Lys Ile Thr Tyr Tyr Arg Asn Gly Lys Glu Glu Thr Thr
    370                 375                 380

Ser Ile Lys Leu Asn Lys Ser Ser Gly Asp Leu Glu Ser
385                 390                 395
```

<210> 153
<211> 939
<212> DNA

<213> Streptococcus pneumoniae

<400> 153
atggcagaaa tttatctagc aggtggttgt ttttggggcc tagaggaata tttttcacgc 60
atttctggag tgctagaaac cagtgttggc tacgctaatg gtcaagtcga aacgaccaat 120
taccagttgc tcaaggaaac agaccatgca gaaacggtcc aagtgattta cgatgagaag 180
gaagtgtcac tcagagagat tttactttat tatttccgag ttatcgatcc tctatctatc 240
aatcaacaag ggaatgaccg tggtcgccaa tatcgaactg ggatttatta tcaggatgaa 300
gcagatttgc cagctatcta cacagtggtg caggagcagg aacgcatgct gggtcgaaag 360
attgcagtag aagtggagca attacgccac tacattctgg ctgaagacta ccaccaagac 420
tatctcagga agaatccttc aggttactgt catatcgatg tgaccgatgc tgataagcca 480
ttgattgatg cagcaaacta tgaaaagcct agtcaagagg tgttgaaggc cagtctatct 540
gaagagtctt atcgtgtcac acaagaagct gctacagagg ctccatttac caatgcctat 600
gaccaaacct ttgaagaggg gatttatgta gatattacga caggtgagcc actcttttt 660
gccaaggata agtttgcttc aggttgtggt tggccaagtt ttagccgtcc gatttccaaa 720
gagttgattc attattacaa ggatctgagc catggaatgg agcgaattga agttcgttct 780
cgttcaggca gtgctcactt gggtcatgtt ttcacagatg gaccgcggga gttaggcggc 840
ctccgttact gtatcaattc tgcttcttta cgctttgtgg ccaaggatga gatggaaaaa 900
gcaggatatg gctatctatt gccttactta aacaaataa 939

<210> 154
<211> 312
<212> PRT
<213> Streptococcus pneumoniae

<400> 154
Met Ala Glu Ile Tyr Leu Ala Gly Gly Cys Phe Trp Gly Leu Glu Glu
1 5 10 15

Tyr Phe Ser Arg Ile Ser Gly Val Leu Glu Thr Ser Val Gly Tyr Ala
20 25 30

Asn Gly Gln Val Glu Thr Thr Asn Tyr Gln Leu Leu Lys Glu Thr Asp
35 40 45

His Ala Glu Thr Val Gln Val Ile Tyr Asp Glu Lys Glu Val Ser Leu
50 55 60

Arg Glu Ile Leu Leu Tyr Tyr Phe Arg Val Ile Asp Pro Leu Ser Ile
65 70 75 80

Asn Gln Gln Gly Asn Asp Arg Gly Arg Gln Tyr Arg Thr Gly Ile Tyr
85 90 95

Tyr Gln Asp Glu Ala Asp Leu Pro Ala Ile Tyr Thr Val Val Gln Glu
100 105 110

Gln Glu Arg Met Leu Gly Arg Lys Ile Ala Val Glu Val Glu Gln Leu
115 120 125

Arg His Tyr Ile Leu Ala Glu Asp Tyr His Gln Asp Tyr Leu Arg Lys
130 135 140

Asn Pro Ser Gly Tyr Cys His Ile Asp Val Thr Asp Ala Asp Lys Pro
145 150 155 160

```
Leu Ile Asp Ala Ala Asn Tyr Glu Lys Pro Ser Gln Glu Val Leu Lys
                165                 170                 175

Ala Ser Leu Ser Glu Glu Ser Tyr Arg Val Thr Gln Glu Ala Ala Thr
            180                 185                 190

Glu Ala Pro Phe Thr Asn Ala Tyr Asp Gln Thr Phe Glu Glu Gly Ile
        195                 200                 205

Tyr Val Asp Ile Thr Thr Gly Glu Pro Leu Phe Phe Ala Lys Asp Lys
    210                 215                 220

Phe Ala Ser Gly Cys Gly Trp Pro Ser Phe Ser Arg Pro Ile Ser Lys
225                 230                 235                 240

Glu Leu Ile His Tyr Tyr Lys Asp Leu Ser His Gly Met Glu Arg Ile
                245                 250                 255

Glu Val Arg Ser Arg Ser Gly Ser Ala His Leu Gly His Val Phe Thr
            260                 265                 270

Asp Gly Pro Arg Glu Leu Gly Gly Leu Arg Tyr Cys Ile Asn Ser Ala
        275                 280                 285

Ser Leu Arg Phe Val Ala Lys Asp Glu Met Glu Lys Ala Gly Tyr Gly
    290                 295                 300

Tyr Leu Leu Pro Tyr Leu Asn Lys
305                 310
```

<210> 155
<211> 870
<212> DNA
<213> Streptococcus pneumoniae

<400> 155
atgaagatta ttgtacctgc aaccagtgcc aatatcgggc caggttttga ctcggtcggt 60
gtagctgtaa ccaagtatct tcaaattgag gtctgcgaag aacgagatga gtggctgatt 120
gaacaccaga ttggcaaatg gattccacat gacgagcgta atctcttgct caaaatcgct 180
ttgcaaattg taccagactt gcaaccaaga cgcttgaaaa tgaccagtga tgtccctttg 240
gcgcgcggtt tgggttcttc cagctcggtt atcgttgctg ggattgaact agccaaccaa 300
ctgggtcaac tcaacttatc agaccatgaa aaattgcagt tagcgaccaa gattgaaggg 360
catcctgaca atgtggctcc agccatttat ggtaatctcg ttattgcaag ttctgttgaa 420
gggcaagtct ctgctatcgt agcagacttt ccagagtgtg attttctagc ttacattcca 480
aactatgaat tacgtactcg cgacagccgt agtgtcttgc ctaaaaaatt gtcttataag 540
gaagctgttg ctgcaagttc tatcgccaat gtagcggttg ctgccttgtt ggcaggagac 600
atggtgaccg ctgggcaagc aatcgaggga gacctcttcc atgagcgcta tcgtcaggac 660
ttggtaagag aatttgcgat gattaagcaa gtgaccaaag aaaatggggc ctatgcaacc 720
tacctttctg gtgctgggcc gacagttatg gttctggctt ctcatgacaa gatgccaaca 780
attaaggcag aattggaaaa gcaacctttc aaaggaaaac tgcatgactt gagagttgat 840
acccaaggtg tccgtgtaga agcaaaataa   870

<210> 156
<211> 289

<212> PRT
<213> Streptococcus pneumoniae

<400> 156
Met Lys Ile Ile Val Pro Ala Thr Ser Ala Asn Ile Gly Pro Gly Phe
1 5 10 15

Asp Ser Val Gly Val Ala Val Thr Lys Tyr Leu Gln Ile Glu Val Cys
20 25 30

Glu Glu Arg Asp Glu Trp Leu Ile Glu His Gln Ile Gly Lys Trp Ile
35 40 45

Pro His Asp Glu Arg Asn Leu Leu Leu Lys Ile Ala Leu Gln Ile Val
50 55 60

Pro Asp Leu Gln Pro Arg Arg Leu Lys Met Thr Ser Asp Val Pro Leu
65 70 75 80

Ala Arg Gly Leu Gly Ser Ser Ser Ser Val Ile Val Ala Gly Ile Glu
85 90 95

Leu Ala Asn Gln Leu Gly Gln Leu Asn Leu Ser Asp His Glu Lys Leu
100 105 110

Gln Leu Ala Thr Lys Ile Glu Gly His Pro Asp Asn Val Ala Pro Ala
115 120 125

Ile Tyr Gly Asn Leu Val Ile Ala Ser Ser Val Glu Gly Gln Val Ser
130 135 140

Ala Ile Val Ala Asp Phe Pro Glu Cys Asp Phe Leu Ala Tyr Ile Pro
145 150 155 160

Asn Tyr Glu Leu Arg Thr Arg Asp Ser Arg Ser Val Leu Pro Lys Lys
165 170 175

Leu Ser Tyr Lys Glu Ala Val Ala Ala Ser Ser Ile Ala Asn Val Ala
180 185 190

Val Ala Ala Leu Leu Ala Gly Asp Met Val Thr Ala Gly Gln Ala Ile
195 200 205

Glu Gly Asp Leu Phe His Glu Arg Tyr Arg Gln Asp Leu Val Arg Glu
210 215 220

Phe Ala Met Ile Lys Gln Val Thr Lys Glu Asn Gly Ala Tyr Ala Thr
225 230 235 240

Tyr Leu Ser Gly Ala Gly Pro Thr Val Met Val Leu Ala Ser His Asp
245 250 255

Lys Met Pro Thr Ile Lys Ala Glu Leu Glu Lys Gln Pro Phe Lys Gly
260 265 270

Lys Leu His Asp Leu Arg Val Asp Thr Gln Gly Val Arg Val Glu Ala
275 280 285

Lys

<210> 157
<211> 564
<212> DNA
<213> Streptococcus pneumoniae

<400> 157
atgaaatatc acgattacat ctgggattta ggtggaactt tactggataa ttatgaaact 60
tcaacagctg catttgttga aacattggca ctgtatggta tcacacaaga ccatgacagt 120
gtctatcaag ctttaaaggt ttctactcct tttgcgattg agacattcgc tcccaattta 180
gagaattttt tagaaaagta caaggaaaat gaagccagag agcttgaaca cccgatttta 240
tttgaaggag tttctgacct attggaagac atttcaaatc aaggtggccg tcatttttg 300
gtctctcatc gaaatgatca ggttttggaa attttagaaa aaacctctat agcagcttat 360
tttacagaag tggtgacttc tagctcaggc tttaagagaa agccaaatcc cgaatccatg 420
ctttatttaa gagaaaagta tcagattagc tctggtcttg tcattggtga tcggccgatt 480
gatatcgaag caggtcaagc tgcaggactt gatacccact tgtttaccag tatcgtgaat 540
ttaagacaag tattagacat ataa 564

<210> 158
<211> 187
<212> PRT
<213> Streptococcus pneumoniae

<400> 158
Met Lys Tyr His Asp Tyr Ile Trp Asp Leu Gly Gly Thr Leu Leu Asp
1 5 10 15

Asn Tyr Glu Thr Ser Thr Ala Ala Phe Val Glu Thr Leu Ala Leu Tyr
20 25 30

Gly Ile Thr Gln Asp His Asp Ser Val Tyr Gln Ala Leu Lys Val Ser
35 40 45

Thr Pro Phe Ala Ile Glu Thr Phe Ala Pro Asn Leu Glu Asn Phe Leu
50 55 60

Glu Lys Tyr Lys Glu Asn Glu Ala Arg Glu Leu Glu His Pro Ile Leu
65 70 75 80

Phe Glu Gly Val Ser Asp Leu Leu Glu Asp Ile Ser Asn Gln Gly Gly
85 90 95

Arg His Phe Leu Val Ser His Arg Asn Asp Gln Val Leu Glu Ile Leu
100 105 110

Glu Lys Thr Ser Ile Ala Ala Tyr Phe Thr Glu Val Val Thr Ser Ser
115 120 125

Ser Gly Phe Lys Arg Lys Pro Asn Pro Glu Ser Met Leu Tyr Leu Arg
130 135 140

```
Glu Lys Tyr Gln Ile Ser Ser Gly Leu Val Ile Gly Asp Arg Pro Ile
145                 150                 155                 160

Asp Ile Glu Ala Gly Gln Ala Ala Gly Leu Asp Thr His Leu Phe Thr
                165                 170                 175

Ser Ile Val Asn Leu Arg Gln Val Leu Asp Ile
            180                 185
```

<210> 159
<211> 1875
<212> DNA
<213> Streptococcus pneumoniae

<400> 159

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atgacagaag aaatcaaaaa tctgcaggca caggattatg atgccagtca aattcaagtt 60
ttagagggct tagaggctgt tcgtatgcgt ccagggatgt acattggatc aacctcaaaa 120
gaaggtcttc accatctagt ctgggaaatt gttgataact caattgacga ggccttggca 180
ggatttgcca gccatattca agtttttatt gagccagatg attcgattac tgttgtggat 240
gatgggcgtg gtatcccagt cgatattcag gaaaaaacag gccgtcctgc tgttgagacc 300
gtctttacag tccttcacgc tggaggaaag ttcggcggtg gtggatacaa ggtttcaggt 360
ggtcttcacg gggtggggtc gtcagtagtt aatgcccttt ccactcaatt agacgttcat 420
gttcacaaaa atggtaagat tcattaccaa gaataccgtc gtggtcatgt tgtcgcagat 480
cttgaaatag ttggagatac ggataaaaca ggaacaactg ttcacttcac accggaccca 540
aaaatcttca ctgaaacaac aatctttgat tttgataaat taaataaacg gattcaagag 600
ttggcctttc taaatcgcgg tcttcaaatt tcaattacag ataagcgcca aggtttggaa 660
caaaccaagc attatcatta tgaaggtggg attgctagtt acgttgaata tatcaacgag 720
aacaaggatg taatctttga tacaccaatc tatacagacg gtgagatgga tgatatcaca 780
gttgaggtag ccatgcagta cacaactggt taccatgaaa atgtcatgag tttcgccaat 840
aatattcata cccatgaagg tggaacacat gaacaaggtt tccgtacagc cttgacacgt 900
gttatcaacg attatgctcg taaaaataag ttactgaaag acaatgaaga taatttaaca 960
ggggaagatg ttcgcgaagg cttaactgca gttatctcag ttaaacaccc aaatccacag 1020
tttgaaggac aaaccaagac caaattggga aatagcgaag tggtcaagat taccaatcgc 1080
ctcttcagtg aagctttctc cgatttcctc atggaaaatc cacagattgc caaacgtatc 1140
gtagaaaaag gaattttggc tgccaaggct cgtgtggctg ccaagcgtgc gcgtgaagtc 1200
acacgtaaaa aatctggttt ggaaatttcc aaccttccag ggaaactagc agactgttct 1260
tctaataacc ctgctgaaac agaactcttc atcgtcgaag gagactcagc tggtggatca 1320
gccaaatctg gtcgtaaccg tgagtttcag gctatccttc caattcgcgg taagattttg 1380
aacgttgaaa aagcaagtat ggataagatt ctagccaacg aagaaattcg tagtcttttc 1440
acagccatgg gaacaggatt tggcgcagaa tttgatgttt cgaaagcccg ttaccaaaaa 1500
ctcgttttga tgaccgatgc cgatgtcgat ggagcccaca ttcgtaccct tcttttaacc 1560
ttgatttatc gttatatgaa accaatccta gaagctggtt atgtttatat tgcccaacca 1620
ccaatctatg gtgtcaaggt tggaagcgag attaaagaat atatccagcc gggtgcagat 1680
caagaaatca aactccaaga agctttagcc cgttatagtg aaggtcgtac caaaccgact 1740
attcagcgtt ataaggggct aggtgaaatg gacgatcatc agctgtggga aacaaccatg 1800
gatcccgaac atcgcttgat ggctagagtt tctgtagatg atgtgcagaa gcagataaaa 1860
tctttgatat gttga                                                  1875
```

<210> 160
<211> 624
<212> PRT
<213> Streptococcus pneumoniae

<400> 160

```
Met Thr Glu Glu Ile Lys Asn Leu Gln Ala Gln Asp Tyr Asp Ala Ser
  1               5                  10                  15

Gln Ile Gln Val Leu Glu Gly Leu Glu Ala Val Arg Met Arg Pro Gly
             20                  25                  30

Met Tyr Ile Gly Ser Thr Ser Lys Glu Gly Leu His His Leu Val Trp
         35                  40                  45

Glu Ile Val Asp Asn Ser Ile Asp Glu Ala Leu Ala Gly Phe Ala Ser
     50                  55                  60

His Ile Gln Val Phe Ile Glu Pro Asp Asp Ser Ile Thr Val Val Asp
 65                  70                  75                  80

Asp Gly Arg Gly Ile Pro Val Asp Ile Gln Glu Lys Thr Gly Arg Pro
                 85                  90                  95

Ala Val Glu Thr Val Phe Thr Val Leu His Ala Gly Gly Lys Phe Gly
            100                 105                 110

Gly Gly Gly Tyr Lys Val Ser Gly Gly Leu His Gly Val Gly Ser Ser
        115                 120                 125

Val Val Asn Ala Leu Ser Thr Gln Leu Asp Val His Val His Lys Asn
    130                 135                 140

Gly Lys Ile His Tyr Gln Glu Tyr Arg Arg Gly His Val Val Ala Asp
145                 150                 155                 160

Leu Glu Ile Val Gly Asp Thr Asp Lys Thr Gly Thr Thr Val His Phe
                165                 170                 175

Thr Pro Asp Pro Lys Ile Phe Thr Glu Thr Thr Ile Phe Asp Phe Asp
            180                 185                 190

Lys Leu Asn Lys Arg Ile Gln Glu Leu Ala Phe Leu Asn Arg Gly Leu
        195                 200                 205

Gln Ile Ser Ile Thr Asp Lys Arg Gln Gly Leu Glu Gln Thr Lys His
    210                 215                 220

Tyr His Tyr Glu Gly Gly Ile Ala Ser Tyr Val Glu Tyr Ile Asn Glu
225                 230                 235                 240

Asn Lys Asp Val Ile Phe Asp Thr Pro Ile Tyr Thr Asp Gly Glu Met
                245                 250                 255

Asp Asp Ile Thr Val Glu Val Ala Met Gln Tyr Thr Thr Gly Tyr His
            260                 265                 270

Glu Asn Val Met Ser Phe Ala Asn Asn Ile His Thr His Glu Gly Gly
        275                 280                 285

Thr His Glu Gln Gly Phe Arg Thr Ala Leu Thr Arg Val Ile Asn Asp
    290                 295                 300
```

```
Tyr Ala Arg Lys Asn Lys Leu Leu Lys Asp Asn Glu Asp Asn Leu Thr
305                 310                 315                 320

Gly Glu Asp Val Arg Glu Gly Leu Thr Ala Val Ile Ser Val Lys His
                325                 330                 335

Pro Asn Pro Gln Phe Glu Gly Gln Thr Lys Thr Lys Leu Gly Asn Ser
            340                 345                 350

Glu Val Val Lys Ile Thr Asn Arg Leu Phe Ser Glu Ala Phe Ser Asp
        355                 360                 365

Phe Leu Met Glu Asn Pro Gln Ile Ala Lys Arg Ile Val Glu Lys Gly
    370                 375                 380

Ile Leu Ala Ala Lys Ala Arg Val Ala Ala Lys Arg Ala Arg Glu Val
385                 390                 395                 400

Thr Arg Lys Lys Ser Gly Leu Glu Ile Ser Asn Leu Pro Gly Lys Leu
                405                 410                 415

Ala Asp Cys Ser Ser Asn Asn Pro Ala Glu Thr Glu Leu Phe Ile Val
            420                 425                 430

Glu Gly Asp Ser Ala Gly Gly Ser Ala Lys Ser Gly Arg Asn Arg Glu
        435                 440                 445

Phe Gln Ala Ile Leu Pro Ile Arg Gly Lys Ile Leu Asn Val Glu Lys
    450                 455                 460

Ala Ser Met Asp Lys Ile Leu Ala Asn Glu Glu Ile Arg Ser Leu Phe
465                 470                 475                 480

Thr Ala Met Gly Thr Gly Phe Gly Ala Glu Phe Asp Val Ser Lys Ala
                485                 490                 495

Arg Tyr Gln Lys Leu Val Leu Met Thr Asp Ala Asp Val Asp Gly Ala
            500                 505                 510

His Ile Arg Thr Leu Leu Leu Thr Leu Ile Tyr Arg Tyr Met Lys Pro
        515                 520                 525

Ile Leu Glu Ala Gly Tyr Val Tyr Ile Ala Gln Pro Pro Ile Tyr Gly
    530                 535                 540

Val Lys Val Gly Ser Glu Ile Lys Glu Tyr Ile Gln Pro Gly Ala Asp
545                 550                 555                 560

Gln Glu Ile Lys Leu Gln Glu Ala Leu Ala Arg Tyr Ser Glu Gly Arg
                565                 570                 575

Thr Lys Pro Thr Ile Gln Arg Tyr Lys Gly Leu Gly Glu Met Asp Asp
            580                 585                 590

His Gln Leu Trp Glu Thr Thr Met Asp Pro Glu His Arg Leu Met Ala
        595                 600                 605
```

```
Arg Val Ser Val Asp Asp Val Gln Lys Gln Ile Lys Ser Leu Ile Cys
    610                 615                 620
```

<210> 161
<211> 1446
<212> DNA
<213> Streptococcus pneumoniae

<400> 161
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atgagtagac gttttaaaaa atcacgttca cagaaagtga agcgaagtgt taatatagtt 60
ttgctgacta tttatttatt gttagtttgt tttttattgt tcttaatctt taagtacaat 120
atccttgctt ttagatatct taatctagtg gtaactgcgt tagtcctact agttgccttg 180
gtagggctac tcttgattat ctataaaaaa gctgaaaagt ttactatttt tctgttggtg 240
ttctctatcc ttgtcagctc tgtgtcgctc tttgcagtac agcagtttgt tggactgacc 300
aatcgtttaa atgcgacttc taattactca gaatattcaa tcagtgtcgc tgttttagca 360
gatagtgaga tcgaaaatgt tacgcaactg acgagtgtga cagcaccgac tgggactaat 420
aatgaaaata ttcagaaatt actagctgat atcaagtcaa gtcagaatac cgatttgacg 480
gtcaaccaga gttcgtctta cttggcagct tacaagagtt tgattgcagg ggagactaag 540
gccattgtcc taaatagtgt ctttgaaaac atcatcgagt cagagtatcc agactacgca 600
tcgaagataa aaaagattta tactaaggga ttcactaaaa aagtagaagc tcctaagacg 660
tctaagagtc agtctttcaa tatctatgtt agtggaattg acacctatgg tcctattagt 720
tcggtgtcgc gatcagatgt caacatcctg atgactgtca atcgagatac caagaaaatc 780
ctcttgacca caacgccacg tgatgcctat gtaccaatcg cagatggtgg aaataatcaa 840
aaagataaat tgactcatgc gggcatttat ggagttgatt cgtccattca caccttagaa 900
aatctctatg gagtggatat caattactat gtgcgattga acttcacttc gtttttgaaa 960
ttgattgatt tgttgggtgg aattgatgtt tataatgatc aagaatttac tgcccatacg 1020
aatggaaagt attaccctgc aggcaatgtt catcttgatt cagaacaggc tctcggtttt 1080
gttcgtgagc gctactccct agcagatggc gatcgtgacc gcgggcgcca tcaacaaaag 1140
gtgattgtgg ctatccttca aaaattaacg tcaaccgaag tgctgaaaaa ttatagtacg 1200
atcattaata gcttgcaaga ttctatccaa acaaatatgc cacttgagac catgataaat 1260
ttggtcaatg ctcagttaga aagtggaggg aattataaag taaattctca agatttaaaa 1320
gggacaggtc ggatggatct tccttcttat gcaatgccag acagtaacct ctatgtgatg 1380
gaaatagatg atagtagttt agctgtagtt aaagcagcta tacaggatgt gatggagggt 1440
agatga                                                          1446
```

<210> 162
<211> 481
<212> PRT
<213> Streptococcus pneumoniae

<400> 162
```
Met Ser Arg Arg Phe Lys Lys Ser Arg Ser Gln Lys Val Lys Arg Ser
  1               5                  10                  15

Val Asn Ile Val Leu Leu Thr Ile Tyr Leu Leu Leu Val Cys Phe Leu
             20                  25                  30

Leu Phe Leu Ile Phe Lys Tyr Asn Ile Leu Ala Phe Arg Tyr Leu Asn
         35                  40                  45

Leu Val Val Thr Ala Leu Val Leu Leu Val Ala Leu Val Gly Leu Leu
```

```
     50                  55                  60

Leu Ile Ile Tyr Lys Lys Ala Glu Lys Phe Thr Ile Phe Leu Leu Val
 65                  70                  75                  80

Phe Ser Ile Leu Val Ser Ser Val Ser Leu Phe Ala Val Gln Gln Phe
                85                  90                  95

Val Gly Leu Thr Asn Arg Leu Asn Ala Thr Ser Asn Tyr Ser Glu Tyr
            100                 105                 110

Ser Ile Ser Val Ala Val Leu Ala Asp Ser Glu Ile Glu Asn Val Thr
        115                 120                 125

Gln Leu Thr Ser Val Thr Ala Pro Thr Gly Thr Asn Asn Glu Asn Ile
    130                 135                 140

Gln Lys Leu Leu Ala Asp Ile Lys Ser Ser Gln Asn Thr Asp Leu Thr
145                 150                 155                 160

Val Asn Gln Ser Ser Ser Tyr Leu Ala Ala Tyr Lys Ser Leu Ile Ala
                165                 170                 175

Gly Glu Thr Lys Ala Ile Val Leu Asn Ser Val Phe Glu Asn Ile Ile
            180                 185                 190

Glu Ser Glu Tyr Pro Asp Tyr Ala Ser Lys Ile Lys Lys Ile Tyr Thr
        195                 200                 205

Lys Gly Phe Thr Lys Lys Val Glu Ala Pro Lys Thr Ser Lys Ser Gln
    210                 215                 220

Ser Phe Asn Ile Tyr Val Ser Gly Ile Asp Thr Tyr Gly Pro Ile Ser
225                 230                 235                 240

Ser Val Ser Arg Ser Asp Val Asn Ile Leu Met Thr Val Asn Arg Asp
                245                 250                 255

Thr Lys Lys Ile Leu Leu Thr Thr Thr Pro Arg Asp Ala Tyr Val Pro
            260                 265                 270

Ile Ala Asp Gly Gly Asn Asn Gln Lys Asp Lys Leu Thr His Ala Gly
        275                 280                 285

Ile Tyr Gly Val Asp Ser Ser Ile His Thr Leu Glu Asn Leu Tyr Gly
    290                 295                 300

Val Asp Ile Asn Tyr Tyr Val Arg Leu Asn Phe Thr Ser Phe Leu Lys
305                 310                 315                 320

Leu Ile Asp Leu Leu Gly Gly Ile Asp Val Tyr Asn Asp Gln Glu Phe
                325                 330                 335

Thr Ala His Thr Asn Gly Lys Tyr Tyr Pro Ala Gly Asn Val His Leu
            340                 345                 350

Asp Ser Glu Gln Ala Leu Gly Phe Val Arg Glu Arg Tyr Ser Leu Ala
```

```
        355                 360                 365

Asp Gly Asp Arg Asp Arg Gly Arg His Gln Gln Lys Val Ile Val Ala
    370                 375                 380

Ile Leu Gln Lys Leu Thr Ser Thr Glu Val Leu Lys Asn Tyr Ser Thr
385                 390                 395                 400

Ile Ile Asn Ser Leu Gln Asp Ser Ile Gln Thr Asn Met Pro Leu Glu
                405                 410                 415

Thr Met Ile Asn Leu Val Asn Ala Gln Leu Glu Ser Gly Gly Asn Tyr
            420                 425                 430

Lys Val Asn Ser Gln Asp Leu Lys Gly Thr Gly Arg Met Asp Leu Pro
        435                 440                 445

Ser Tyr Ala Met Pro Asp Ser Asn Leu Tyr Val Met Glu Ile Asp Asp
    450                 455                 460

Ser Ser Leu Ala Val Val Lys Ala Ala Ile Gln Asp Val Met Glu Gly
465                 470                 475                 480

Arg
```

<210> 163
<211> 732
<212> DNA
<213> Streptococcus pneumoniae

<400> 163
atgatagaca tccattcgca tatcgttttt gatgtagatg acggtcccaa gtcaagagag 60
gaaagcaagg ctctcttggc agaatcctac agacaggggg tgcgaaccat tgtttctacc 120
tctcaccgtc gcaagggcat gtttgaaact ccggaagaga agatagcaga aaactttctt 180
caggttcggg aaatagctaa ggaagtggcg agtgacttgg tcattgctta cggggctgaa 240
atttattaca caccagatgt tctggataag ctggaaaaaa agcggattcc gaccctcaat 300
gatagtcgtt atgccttgat agagtttagt atgaacactc cttatcgcga tattcatagc 360
gccttgagca agatcttgat gttgggaatt actccagtca ttgcccacat tgagcgctat 420
gatgctcttg aaaataatga aaaacgcgtt cgagaactga tcgatatggg ctgttacacg 480
caagtaaata gttcacatgt cctcaaaccc aaacttttg gcgaacgtta taaattcatg 540
aaaaaaagag ctcagtattt tttagagcag gatttggttc atgtcattgc aagtgatatg 600
cacaatctag acggtagacc tcctcatatg gcagaagcat atgaccttgt tacccaaaaa 660
tacggagaag cgaaggctca ggaacttttt atagacaatc ctcgaaaaat tgtaatggat 720
caactaattt ag 732

<210> 164
<211> 243
<212> PRT
<213> Streptococcus pneumoniae

<400> 164
```
Met Ile Asp Ile His Ser His Ile Val Phe Asp Val Asp Asp Gly Pro
  1               5                  10                  15
```

```
Lys Ser Arg Glu Glu Ser Lys Ala Leu Leu Ala Glu Ser Tyr Arg Gln
            20                  25                  30

Gly Val Arg Thr Ile Val Ser Thr Ser His Arg Arg Lys Gly Met Phe
        35                  40                  45

Glu Thr Pro Glu Glu Lys Ile Ala Glu Asn Phe Leu Gln Val Arg Glu
    50                  55                  60

Ile Ala Lys Glu Val Ala Ser Asp Leu Val Ile Ala Tyr Gly Ala Glu
65                  70                  75                  80

Ile Tyr Tyr Thr Pro Asp Val Leu Asp Lys Leu Glu Lys Lys Arg Ile
                85                  90                  95

Pro Thr Leu Asn Asp Ser Arg Tyr Ala Leu Ile Glu Phe Ser Met Asn
            100                 105                 110

Thr Pro Tyr Arg Asp Ile His Ser Ala Leu Ser Lys Ile Leu Met Leu
        115                 120                 125

Gly Ile Thr Pro Val Ile Ala His Ile Glu Arg Tyr Asp Ala Leu Glu
    130                 135                 140

Asn Asn Glu Lys Arg Val Arg Glu Leu Ile Asp Met Gly Cys Tyr Thr
145                 150                 155                 160

Gln Val Asn Ser Ser His Val Leu Lys Pro Lys Leu Phe Gly Glu Arg
                165                 170                 175

Tyr Lys Phe Met Lys Lys Arg Ala Gln Tyr Phe Leu Glu Gln Asp Leu
            180                 185                 190

Val His Val Ile Ala Ser Asp Met His Asn Leu Asp Gly Arg Pro Pro
        195                 200                 205

His Met Ala Glu Ala Tyr Asp Leu Val Thr Gln Lys Tyr Gly Glu Ala
    210                 215                 220

Lys Ala Gln Glu Leu Phe Ile Asp Asn Pro Arg Lys Ile Val Met Asp
225                 230                 235                 240

Gln Leu Ile
```

<210> 165
<211> 3990
<212> DNA
<213> Streptococcus pneumoniae

<400> 165
ttgatttata taatcgctat caatataaca atgcaatcag gaggttttgc aatgaaacat 60
gaaaaacaac agcgtttttc tattcgtaaa tacgctgtag gagcagcttc tgttctaatt 120
ggatttgcct tccaagcaca gactgttgca gccgatggag ttactcctac tactacagaa 180

aaccaaccga ccatccatac ggtttctgat tcccctcaat catccgaaaa tcggactgag 240
gaaacaccta aagcagtgct tcaaccagaa gctccaaaaa ctgtagaaac agaaactcca 300
gctactgata aggtagctag tcttccaaaa acagaagaaa aaccacaaga ggaagttagt 360
tcaactccta gtgataaagc agaagtggta actccaactt ctgctgaaaa agaaactgct 420
aataaaaagg cagaagaagc tagccctaaa aaggaagaag cgaaagaggt tgattctaaa 480
gagtcaaata cagacaagac tgacaaggat aaaccagcta aaaaagatga agcgaaagca 540
gaggctgaca aaccggcaac agaggcagga aaggaacgtg ctgcaactgt aaatgaaaaa 600
ctagcgaaaa agaaaattgt ttctattgat gctggacgta aatatttctc accagaacag 660
ctcaaggaaa tcatcgataa agcgaaacat tatggctaca ctgatttaca cctattagtc 720
ggaaatgatg gactccgttt catgttggac gatatgagca tcacagctaa cggcaagacc 780
tatgccagtg acgatgtcaa acgcgccatt gaaaaaggta caaatgatta ttacaacgat 840
ccaaacggca atcacttaac agaaagtcaa atgacagatc tgattaacta tgccaaagat 900
aaaggtatcg gtctcattcc gacagtaaat agtcctggac acatggatgc gattctcaat 960
gccatgaaag aattgggaat ccaaaaccct aactttagct attttgggaa gaaatcagcc 1020
cgtactgtcg atcttgacaa cgaacaagct gtcgctttta caaaagccct tatcgacaag 1080
tatgctgctt atttcgcgaa aaagactgaa atcttcaaca tcggacttga tgaatatgcc 1140
aatgatgcga cagatgctaa aggttggagt gtgcttcaag ctgataaata ctatccaaac 1200
gaaggctacc ctgtaaaagg ctatgaaaaa tttattgcct acgccaatga cctcgctcgt 1260
attgtaaaat cgcacggtct caaaccaatg gcttttaacg acggtatcta ctacaatagc 1320
gacacaagct ttggtagttt tgacaaagac atcatcgttt ctatgtggac tggtggttgg 1380
ggaggctacg atgtcgcttc ttctaaacta ctagctgaaa aaggtcacca aatccttaat 1440
accaatgatg cttggtacta cgttcttgga cgaaacgctg atggccaagg ctggtacaat 1500
ctcgatcagg ggctcaatgg tattaaaaac acaccaatca cttctgtacc aaaaacagaa 1560
ggagctgata tcccaatcat cggtggtatg gtagctgctt gggctgacac tccatctgca 1620
cgttattcac catcacgcct cttcaaactc atgcgtcatt ttgcaaatgc caacgctgaa 1680
tacttcgcag ctgattatga atctgcagag caagcactta acgaggtacc aaaagacctg 1740
aaccgttata ctgcagaaag cgtcacggcc gtaaaagaag ctgaaaaagc tattcgctct 1800
ctcgatagca accttagccg tgcccaacaa gatacgattg atcaagccat tgctaaactt 1860
caagaaactg tcaacaactt gaccctcacg cctgaagctc aaaaagaaga agaagctaaa 1920
cgtgaggttg aaaaacttgc caaaaacaag gtaatctcaa tcgatgctgg acgcaaatac 1980
tttactctga accagctcaa acgcatcgta gacaaggcca gtgagctcgg atattctgat 2040
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gccaacggaa aaacctatgc tagtgatgac gttaaaaaag ctattatcga aggaactaaa 2160
gcttactacg acgatccaaa cggtactgca ctaacacagg cagaagtaac agagctaatt 2220
gaatacgcta aatctaagga catcggtctc atcccagcta ttaacagtcc aggtcacatg 2280
gatgctatgc tggttgccat ggaaaaatta ggtattaaaa atcctcaagc ccactttgat 2340
aaagtttcaa aaacaactat ggacttgaaa aacgaagaag cgatgaactt tgtaaaagcc 2400
ctcatcggta aatacatgga cttctttgca ggtaaaacaa agattttcaa ctttggtact 2460
gacgaatacg ccaacgatgc gactagtgcc caaggctggt actacctcaa gtggtatcaa 2520
ctctatggca aatttgccga atatgccaac accctcgcag ctatggccaa agaaagaggg 2580
cttcaaccaa tggccttcaa cgatggcttc tactatgaag acaaggacga tgttcagttt 2640
gacaaagatg tcttgatttc ttactggtct aaaggctggt ggggatataa cctcgcatca 2700
cctcaatacc tagcaagcaa aggctataaa ttcttgaata ccaacggtga ctggtactac 2760
attcttggtc aaaaaccaga agatggtggt ggtttcctca agaaagctat tgagaatact 2820
ggaaaaacac cattcaatca actagcttct accaaatatc ctgaagtaga tcttccaaca 2880
gtcggaagta tgctttcaat ctgggcagat agaccaagcg ctgaatacaa ggaagaggaa 2940
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aatgctctcc gcgaagaatt agctaaaatt cctacaaact tagaaggata tagtaaagaa 3060
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caagctgagc ttgacacgct tgtagccaac ctaaaagccg ctcttcaagg cctcaaacca 3180
gctgtaactc attcaggaag cctagatgaa aatgaagtgg ctgccaatgt tgaaaccaga 3240
ccagaactca tcacaagaac tgaagaaatt ccatttgaag ttatcaagaa agaaaatcct 3300
aacctcccag ccggtcagga aaatattatc acagcaggag tcaaaggtga acgaactcat 3360
tacatctctg tactcactga aaatggaaaa acaacagaaa cagtccttga tagccaggta 3420
accaaagaag ttataaacca agtggttgaa gttggcgctc ctgtaactca caagggtgat 3480
gaaagtggtc ttgcaccaac tactgaggta aaacctagac tggatatcca agaagaagaa 3540
attccattta ccacagtgac ttgtgaaaat ccactcttac tcaaaggaaa aacacaagtc 3600

```
attactaagg gcgtcaatgg acatcgtagc aacttctact ctgtgagcac ttctgccgat 3660
ggtaaggaag tgaaaacact tgtaaatagt gtcgtagcac aggaagccgt tactcaaata 3720
gtcgaagtcg gaactatggt aacacatgta ggcgatgaaa acggacaagc cgctattgct 3780
gaagaaaaac caaaactaga aatcccaagc caaccagctc catcaactgc tcctgctgag 3840
gaaagcaaag ttcttcctca agatccagct cctgtggtaa cagagaaaaa acttcctgaa 3900
acaggaactc acgattctgc aggactagta gtcgcaggac tcatgtccac actagcagcc 3960
tatggactca ctaaaagaaa agaagactaa                                  3990
```

<210> 166
<211> 1329
<212> PRT
<213> Streptococcus pneumoniae

<400> 166

```
Met Ile Tyr Ile Ile Ala Ile Asn Ile Thr Met Gln Ser Gly Gly Phe
  1               5                  10                  15

Ala Met Lys His Glu Lys Gln Gln Arg Phe Ser Ile Arg Lys Tyr Ala
             20                  25                  30

Val Gly Ala Ala Ser Val Leu Ile Gly Phe Ala Phe Gln Ala Gln Thr
         35                  40                  45

Val Ala Ala Asp Gly Val Thr Pro Thr Thr Thr Glu Asn Gln Pro Thr
     50                  55                  60

Ile His Thr Val Ser Asp Ser Pro Gln Ser Ser Glu Asn Arg Thr Glu
 65                  70                  75                  80

Glu Thr Pro Lys Ala Val Leu Gln Pro Glu Ala Pro Lys Thr Val Glu
                 85                  90                  95

Thr Glu Thr Pro Ala Thr Asp Lys Val Ala Ser Leu Pro Lys Thr Glu
            100                 105                 110

Glu Lys Pro Gln Glu Glu Val Ser Ser Thr Pro Ser Asp Lys Ala Glu
        115                 120                 125

Val Val Thr Pro Thr Ser Ala Glu Lys Glu Thr Ala Asn Lys Lys Ala
    130                 135                 140

Glu Glu Ala Ser Pro Lys Lys Glu Glu Ala Lys Glu Val Asp Ser Lys
145                 150                 155                 160

Glu Ser Asn Thr Asp Lys Thr Asp Lys Asp Lys Pro Ala Lys Lys Asp
                165                 170                 175

Glu Ala Lys Ala Glu Ala Asp Lys Pro Ala Thr Glu Ala Gly Lys Glu
            180                 185                 190

Arg Ala Ala Thr Val Asn Glu Lys Leu Ala Lys Lys Lys Ile Val Ser
        195                 200                 205

Ile Asp Ala Gly Arg Lys Tyr Phe Ser Pro Glu Gln Leu Lys Glu Ile
    210                 215                 220
```

```
Ile Asp Lys Ala Lys His Tyr Gly Tyr Thr Asp Leu His Leu Leu Val
225                 230                 235                 240

Gly Asn Asp Gly Leu Arg Phe Met Leu Asp Asp Met Ser Ile Thr Ala
                245                 250                 255

Asn Gly Lys Thr Tyr Ala Ser Asp Asp Val Lys Arg Ala Ile Glu Lys
            260                 265                 270

Gly Thr Asn Asp Tyr Tyr Asn Asp Pro Asn Gly Asn His Leu Thr Glu
        275                 280                 285

Ser Gln Met Thr Asp Leu Ile Asn Tyr Ala Lys Asp Lys Gly Ile Gly
    290                 295                 300

Leu Ile Pro Thr Val Asn Ser Pro Gly His Met Asp Ala Ile Leu Asn
305                 310                 315                 320

Ala Met Lys Glu Leu Gly Ile Gln Asn Pro Asn Phe Ser Tyr Phe Gly
                325                 330                 335

Lys Lys Ser Ala Arg Thr Val Asp Leu Asp Asn Glu Gln Ala Val Ala
            340                 345                 350

Phe Thr Lys Ala Leu Ile Asp Lys Tyr Ala Ala Tyr Phe Ala Lys Lys
        355                 360                 365

Thr Glu Ile Phe Asn Ile Gly Leu Asp Glu Tyr Ala Asn Asp Ala Thr
    370                 375                 380

Asp Ala Lys Gly Trp Ser Val Leu Gln Ala Asp Lys Tyr Tyr Pro Asn
385                 390                 395                 400

Glu Gly Tyr Pro Val Lys Gly Tyr Glu Lys Phe Ile Ala Tyr Ala Asn
                405                 410                 415

Asp Leu Ala Arg Ile Val Lys Ser His Gly Leu Lys Pro Met Ala Phe
            420                 425                 430

Asn Asp Gly Ile Tyr Tyr Asn Ser Asp Thr Ser Phe Gly Ser Phe Asp
        435                 440                 445

Lys Asp Ile Ile Val Ser Met Trp Thr Gly Gly Trp Gly Gly Tyr Asp
    450                 455                 460

Val Ala Ser Ser Lys Leu Leu Ala Glu Lys Gly His Gln Ile Leu Asn
465                 470                 475                 480

Thr Asn Asp Ala Trp Tyr Tyr Val Leu Gly Arg Asn Ala Asp Gly Gln
                485                 490                 495

Gly Trp Tyr Asn Leu Asp Gln Gly Leu Asn Gly Ile Lys Asn Thr Pro
            500                 505                 510

Ile Thr Ser Val Pro Lys Thr Glu Gly Ala Asp Ile Pro Ile Ile Gly
        515                 520                 525
```

```
Gly Met Val Ala Ala Trp Ala Asp Thr Pro Ser Ala Arg Tyr Ser Pro
    530                 535                 540

Ser Arg Leu Phe Lys Leu Met Arg His Phe Ala Asn Ala Asn Ala Glu
545                 550                 555                 560

Tyr Phe Ala Ala Asp Tyr Glu Ser Ala Glu Gln Ala Leu Asn Glu Val
                565                 570                 575

Pro Lys Asp Leu Asn Arg Tyr Thr Ala Glu Ser Val Thr Ala Val Lys
            580                 585                 590

Glu Ala Glu Lys Ala Ile Arg Ser Leu Asp Ser Asn Leu Ser Arg Ala
        595                 600                 605

Gln Gln Asp Thr Ile Asp Gln Ala Ile Ala Lys Leu Gln Glu Thr Val
    610                 615                 620

Asn Asn Leu Thr Leu Thr Pro Glu Ala Gln Lys Glu Glu Glu Ala Lys
625                 630                 635                 640

Arg Glu Val Glu Lys Leu Ala Lys Asn Lys Val Ile Ser Ile Asp Ala
                645                 650                 655

Gly Arg Lys Tyr Phe Thr Leu Asn Gln Leu Lys Arg Ile Val Asp Lys
            660                 665                 670

Ala Ser Glu Leu Gly Tyr Ser Asp Val His Leu Leu Leu Gly Asn Asp
        675                 680                 685

Gly Leu Arg Phe Leu Leu Asp Asp Met Thr Ile Thr Ala Asn Gly Lys
    690                 695                 700

Thr Tyr Ala Ser Asp Asp Val Lys Lys Ala Ile Ile Glu Gly Thr Lys
705                 710                 715                 720

Ala Tyr Tyr Asp Asp Pro Asn Gly Thr Ala Leu Thr Gln Ala Glu Val
                725                 730                 735

Thr Glu Leu Ile Glu Tyr Ala Lys Ser Lys Asp Ile Gly Leu Ile Pro
            740                 745                 750

Ala Ile Asn Ser Pro Gly His Met Asp Ala Met Leu Val Ala Met Glu
        755                 760                 765

Lys Leu Gly Ile Lys Asn Pro Gln Ala His Phe Asp Lys Val Ser Lys
    770                 775                 780

Thr Thr Met Asp Leu Lys Asn Glu Glu Ala Met Asn Phe Val Lys Ala
785                 790                 795                 800

Leu Ile Gly Lys Tyr Met Asp Phe Phe Ala Gly Lys Thr Lys Ile Phe
                805                 810                 815

Asn Phe Gly Thr Asp Glu Tyr Ala Asn Asp Ala Thr Ser Ala Gln Gly
            820                 825                 830
```

```
Trp Tyr Tyr Leu Lys Trp Tyr Gln Leu Tyr Gly Lys Phe Ala Glu Tyr
        835                 840                 845

Ala Asn Thr Leu Ala Ala Met Ala Lys Glu Arg Gly Leu Gln Pro Met
    850                 855                 860

Ala Phe Asn Asp Gly Phe Tyr Tyr Glu Asp Lys Asp Asp Val Gln Phe
865                 870                 875                 880

Asp Lys Asp Val Leu Ile Ser Tyr Trp Ser Lys Gly Trp Trp Gly Tyr
                885                 890                 895

Asn Leu Ala Ser Pro Gln Tyr Leu Ala Ser Lys Gly Tyr Lys Phe Leu
            900                 905                 910

Asn Thr Asn Gly Asp Trp Tyr Tyr Ile Leu Gly Gln Lys Pro Glu Asp
        915                 920                 925

Gly Gly Gly Phe Leu Lys Lys Ala Ile Glu Asn Thr Gly Lys Thr Pro
    930                 935                 940

Phe Asn Gln Leu Ala Ser Thr Lys Tyr Pro Glu Val Asp Leu Pro Thr
945                 950                 955                 960

Val Gly Ser Met Leu Ser Ile Trp Ala Asp Arg Pro Ser Ala Glu Tyr
                965                 970                 975

Lys Glu Glu Glu Ile Phe Glu Leu Met Thr Ala Phe Ala Asp His Asn
            980                 985                 990

Lys Asp Tyr Phe Arg Ala Asn Tyr Asn Ala Leu Arg Glu Glu Leu Ala
        995                1000                1005

Lys Ile Pro Thr Asn Leu Glu Gly Tyr Ser Lys Glu Ser Leu Glu Ala
   1010                1015                1020

Leu Asp Ala Ala Lys Thr Ala Leu Asn Tyr Asn Leu Asn Arg Asn Lys
1025                1030                1035                1040

Gln Ala Glu Leu Asp Thr Leu Val Ala Asn Leu Lys Ala Ala Leu Gln
               1045                1050                1055

Gly Leu Lys Pro Ala Val Thr His Ser Gly Ser Leu Asp Glu Asn Glu
           1060                1065                1070

Val Ala Ala Asn Val Glu Thr Arg Pro Glu Leu Ile Thr Arg Thr Glu
       1075                1080                1085

Glu Ile Pro Phe Glu Val Ile Lys Lys Glu Asn Pro Asn Leu Pro Ala
   1090                1095                1100

Gly Gln Glu Asn Ile Ile Thr Ala Gly Val Lys Gly Glu Arg Thr His
1105                1110                1115                1120

Tyr Ile Ser Val Leu Thr Glu Asn Gly Lys Thr Thr Glu Thr Val Leu
               1125                1130                1135
```

```
Asp Ser Gln Val Thr Lys Glu Val Ile Asn Gln Val Val Glu Val Gly
          1140                1145                1150

Ala Pro Val Thr His Lys Gly Asp Glu Ser Gly Leu Ala Pro Thr Thr
       1155                1160                1165

Glu Val Lys Pro Arg Leu Asp Ile Gln Glu Glu Glu Ile Pro Phe Thr
   1170                1175                1180

Thr Val Thr Cys Glu Asn Pro Leu Leu Leu Lys Gly Lys Thr Gln Val
1185                1190                1195                1200

Ile Thr Lys Gly Val Asn Gly His Arg Ser Asn Phe Tyr Ser Val Ser
               1205                1210                1215

Thr Ser Ala Asp Gly Lys Glu Val Lys Thr Leu Val Asn Ser Val Val
          1220                1225                1230

Ala Gln Glu Ala Val Thr Gln Ile Val Glu Val Gly Thr Met Val Thr
       1235                1240                1245

His Val Gly Asp Glu Asn Gly Gln Ala Ala Ile Ala Glu Glu Lys Pro
   1250                1255                1260

Lys Leu Glu Ile Pro Ser Gln Pro Ala Pro Ser Thr Ala Pro Ala Glu
1265                1270                1275                1280

Glu Ser Lys Val Leu Pro Gln Asp Pro Ala Pro Val Val Thr Glu Lys
               1285                1290                1295

Lys Leu Pro Glu Thr Gly Thr His Asp Ser Ala Gly Leu Val Val Ala
          1300                1305                1310

Gly Leu Met Ser Thr Leu Ala Ala Tyr Gly Leu Thr Lys Arg Lys Glu
       1315                1320                1325

Asp
```

<210> 167
<211> 825
<212> DNA
<213> Streptococcus pneumoniae

<400> 167
atgaacaaaa aaacaagaca gacactaatc ggactgctag tgttattgct tttgtctaca 60
gggagctatt atatcaagca gatgccgtcg gcacctaata gtcccaaaac caatcttagt 120
cagaaaaaac aagcgtctga agctcctagt caagcattgg cagagagtgt cttaacagac 180
gcagtcaaga gtcaaataaa ggggagtctg gagtggaatg gctcaggtgc ttttatcgtc 240
aatggtaata aaacaaatct agatgccaag gtttcaagta agccctacgc tgacaataaa 300
acaaagacag tgggcaagga aactgttcca accgtagcta atgccctctt gtctaaggcc 360
actcgtcagt acaagaatcg taaagaaact gggaatggtt caacttcttg gactcctcca 420
ggttggcatc aggtcaagaa tctaaagggc tcttataccc atgcagtcga tagaggtcat 480
ttgttaggct atgccttaat cggtggtttg gatggttttg atgcctcaac aagcaatcct 540
aaaaacattg ctgttcagac agcctgggca aatcaggcac aagccgagta ttcgactggt 600

caaaactact atgaaagcaa ggtgcgtaaa gccttggacc aaaacaagcg tgtccgttac 660
cgtgtaaccc tttactacgc ttcaaacgag gatttagttc cctcagcttc acagattgaa 720
gccaagtctt cggatggaga attggaattc aatgttctag ttcccaatgt tcaaaaggga 780
cttcaactgg attaccgaac tggagaagta actgtaactc agtaa 825

<210> 168
<211> 274
<212> PRT
<213> Streptococcus pneumoniae

<400> 168

```
Met Asn Lys Lys Thr Arg Gln Thr Leu Ile Gly Leu Leu Val Leu Leu
  1               5                  10                  15

Leu Leu Ser Thr Gly Ser Tyr Tyr Ile Lys Gln Met Pro Ser Ala Pro
             20                  25                  30

Asn Ser Pro Lys Thr Asn Leu Ser Gln Lys Lys Gln Ala Ser Glu Ala
         35                  40                  45

Pro Ser Gln Ala Leu Ala Glu Ser Val Leu Thr Asp Ala Val Lys Ser
     50                  55                  60

Gln Ile Lys Gly Ser Leu Glu Trp Asn Gly Ser Gly Ala Phe Ile Val
 65                  70                  75                  80

Asn Gly Asn Lys Thr Asn Leu Asp Ala Lys Val Ser Ser Lys Pro Tyr
                 85                  90                  95

Ala Asp Asn Lys Thr Lys Thr Val Gly Lys Glu Thr Val Pro Thr Val
            100                 105                 110

Ala Asn Ala Leu Leu Ser Lys Ala Thr Arg Gln Tyr Lys Asn Arg Lys
        115                 120                 125

Glu Thr Gly Asn Gly Ser Thr Ser Trp Thr Pro Pro Gly Trp His Gln
    130                 135                 140

Val Lys Asn Leu Lys Gly Ser Tyr Thr His Ala Val Asp Arg Gly His
145                 150                 155                 160

Leu Leu Gly Tyr Ala Leu Ile Gly Gly Leu Asp Gly Phe Asp Ala Ser
                165                 170                 175

Thr Ser Asn Pro Lys Asn Ile Ala Val Gln Thr Ala Trp Ala Asn Gln
            180                 185                 190

Ala Gln Ala Glu Tyr Ser Thr Gly Gln Asn Tyr Tyr Glu Ser Lys Val
        195                 200                 205

Arg Lys Ala Leu Asp Gln Asn Lys Arg Val Arg Tyr Arg Val Thr Leu
    210                 215                 220

Tyr Tyr Ala Ser Asn Glu Asp Leu Val Pro Ser Ala Ser Gln Ile Glu
225                 230                 235                 240
```

```
Ala Lys Ser Ser Asp Gly Glu Leu Glu Phe Asn Val Leu Val Pro Asn
                245                 250                 255

Val Gln Lys Gly Leu Gln Leu Asp Tyr Arg Thr Gly Glu Val Thr Val
            260                 265                 270

Thr Gln
```

<210> 169
<211> 225
<212> DNA
<213> Streptococcus pneumoniae

<400> 169
gtgctaagat tcagcggatt gaggcaagtg atgaagatga ataagaaatc aagctacgta 60
gtcaagcgtt tacttttagt catcatagta ctgattttag gtactctggc tctaggaatc 120
ggtttaatgg taggttatgg aatcttgggc aagggtcaag atccatgggc tatcctgtct 180
ccagcaaaat ggcaggaatt gattcataaa tttacaggaa attag 225

<210> 170
<211> 74
<212> PRT
<213> Streptococcus pneumoniae

<400> 170
```
Val Leu Arg Phe Ser Gly Leu Arg Gln Val Met Lys Met Asn Lys Lys
  1               5                  10                  15

Ser Ser Tyr Val Val Lys Arg Leu Leu Leu Val Ile Ile Val Leu Ile
             20                  25                  30

Leu Gly Thr Leu Ala Leu Gly Ile Gly Leu Met Val Gly Tyr Gly Ile
         35                  40                  45

Leu Gly Lys Gly Gln Asp Pro Trp Ala Ile Leu Ser Pro Ala Lys Trp
     50                  55                  60

Gln Glu Leu Ile His Lys Phe Thr Gly Asn
 65                  70
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<210> 171
<211> 40
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 171
cgagatctga tatctcacaa acagataacg gcgtaaatag 40

<210> 172
<211> 43
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 172
gaagatcttc cccgggatca caaacagata acggcgtaaa tag 43

<210> 173
<211> 42
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 173
cgagatctga tatccatcac aaacagataa cggcgtaaat ag 42

<210> 174
<211> 32
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 174
cgggatcctt atggacctga atcagcgttg tc 32

<210> 175
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 175
ggatgctttg tttcaggtgt atc 23

<210> 176
<211> 82
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 176
catgatatcg gtacctcaag ctcatatcat tgtccggcaa tggtgtgggc ttttttttgtt 60
ttagcggata acaatttcac ac 82

<210> 177
<211> 81
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 177
gcggatcccc cgggcttaat taatgtttaa acactagtcg aagatctcgc gaattctcct 60
gtgtgaaatt gttatccgct a 81

<210> 178
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 178
cgccagggtt ttcccagtca cgac 24

<210> 179
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 179
tcaggggggc ggagcctatg 20

<210> 180
<211> 22
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 180
tcgtatgttg tgtggaattg tg 22

<210> 181
<211> 26
<212> DNA

<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 181
tccggctcgt atgttgtgtg gaattg 26

<210> 182
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<221> SITE
<222> (3)
<223> Xaa=Any amino acid

<220>
<223> Description of Artificial Sequence: Cell wall anchoring motif

<400> 182
Leu Pro Xaa Thr Gly
1 5

<210> 183
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 183
gcgggatccg ccaccatg 18

<210> 184
<211> 10
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 184
ttgcggccgc 10

<210> 185
<211> 43
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 185
cggatccgcc accatgggtc taattgaaga cttaaaaaat caa 43

<210> 186
<211> 36
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 186
ttgcggccgc caatgctaga ctaaacacaa gactca 36

<210> 187
<211> 36
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 187
cgcggatcca tgaaaaaaat ctattcattt ttagca 36

<210> 188
<211> 38
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 188
ccctcgaggg ctacttccga tacattttaa actgtagg 38

<210> 189
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 189
cggatccgcc accatgagtc atgtcgctgc aaatg 35

<210> 190

<211> 32
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 190
ttgcggccgc ataccaaacg ctgacatcta cg 32

<210> 191
<211> 38
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 191
cggatccgcc accatgcaaa aagagcggta tggttatg 38

<210> 192
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 192
ttgcggccgc acccccattc ttaatccctt 30

<210> 193
<211> 40
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 193
cggatccgcc accatggagg tatgtgaaat gtcacgtaaa 40

<210> 194
<211> 32
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 194
ttgcggccgc ttttacaaag tcaagcaaag cc 32

<210> 195
<211> 48
<212> PRT
<213> Streptococcus pneumoniae

<400> 195
Gly Ile Arg Leu Arg Asn Met Leu Phe Lys Ile Trp Pro Ala Val Ala
1 5 10 15

Leu Val Thr Ser Ser Gly Asn Asn Val Ser Met Leu His Ser Ile Ala
20 25 30

Asn Met Gly Gln Leu Thr Leu Gly Thr Gln Cys Gln Thr Val Val Val
35 40 45

<210> 196
<211> 11
<212> PRT
<213> Streptococcus pneumoniae

<400> 196
Gln Lys Ile Thr Met Ile Thr Phe Thr Phe Gln
1 5 10

<210> 197
<211> 4
<212> PRT
<213> Artificial Sequence

<220>
<221> SITE
<222> (2-3)
<223> Xaa=Any amino acid

<220>
<223> Description of Artificial Sequence: Ipoprotein attachment sites

<400> 197
Leu Xaa Xaa Cys
1